Engineering Library

Telephone Engineer

VOL. 31. NO. 12. CHICAGO

Exacting Inspection Methods Insure Strowger Automatic Quality

EVERY step in the manufacture of Strowger Automatic telephone equipment, from the raw material to the finished product, is subjected to the constant supervision of experts and every unit must pass successive inspections designed to reveal the slightest flaw in material, construction or operation. The long series of tests which every switching unit must pass definitely insure every component part being virtually perfect from every standpoint.

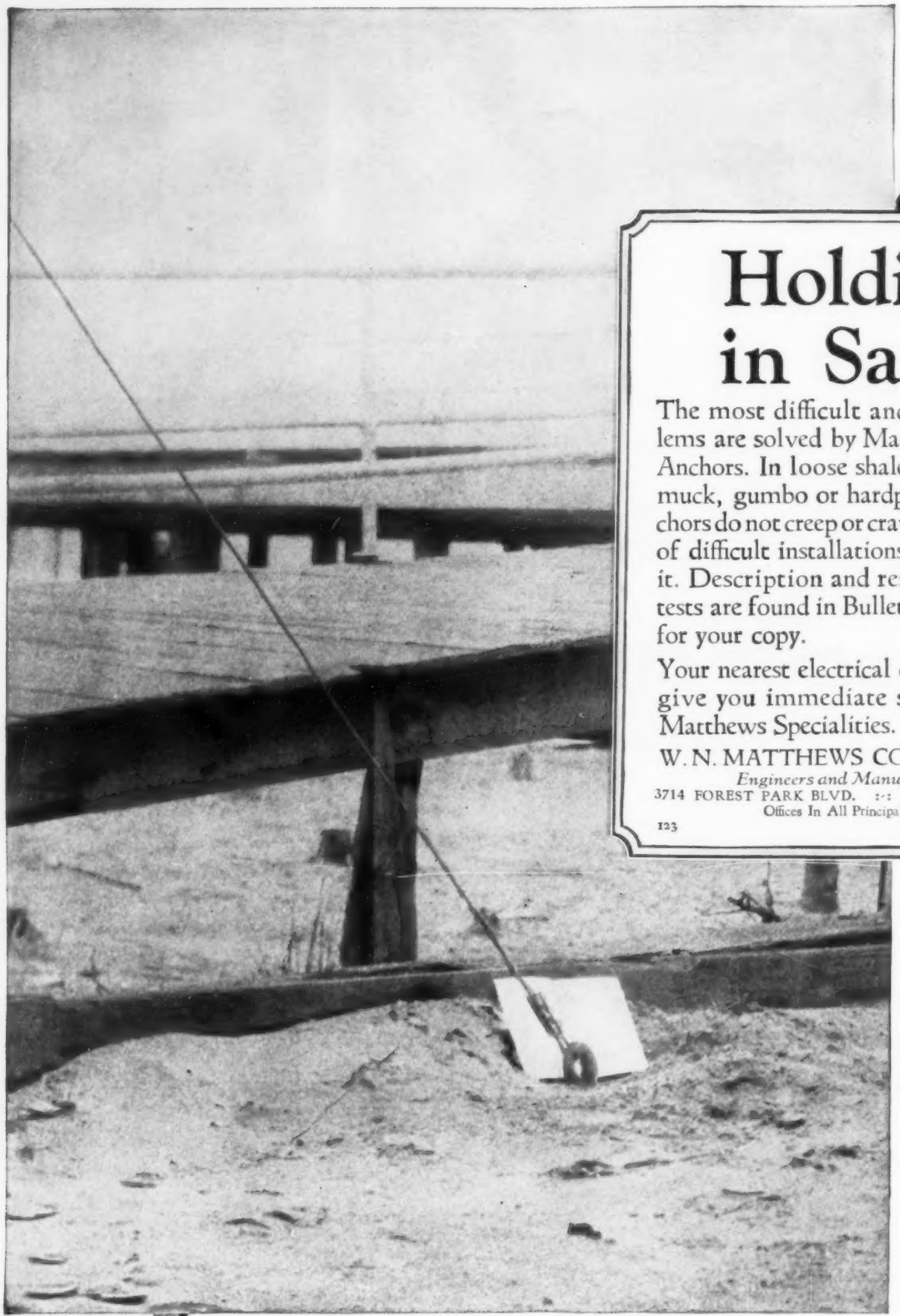
The high reputation for performance, dependability and long life which Strowger Automatic telephone equipment enjoys today is the result of the thorough system of inspection which has been maintained by Automatic Electric Inc. from its earliest days, and the exact control of quality which has been insisted upon at every step in manufacture. That Strowger Automatic equipment has always been in advance of the telephone art is due largely to that spirit of insistence which demands the best in every stage of its development, its production and its installation.

Automatic Electric Inc.

Factory and General Offices: 1033 West Van Buren St.
Chicago, U. S. A.

STROWGER AUTOMATIC

DECEMBER, 1927



Holding in Sand

The most difficult anchoring problems are solved by Matthews Scrulix Anchors. In loose shale, loam, sand, muck, gumbo or hardpan, these Anchors do not creep or crawl. Thousands of difficult installations have proven it. Description and results of many tests are found in Bulletin 802. Write for your copy.

Your nearest electrical distributer can give you immediate service on all Matthews Specialities.

W. N. MATTHEWS CORPORATION
Engineers and Manufacturers
3714 FOREST PARK BLVD. :-: ST. LOUIS U. S. A.
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123

A Matthews Scrulix Anchor firmly in place—permanently.

MATTHEWS
SCRULIX ANCHORS
Look for "SCRULIX" on the Helix

TELEPHONE ENGINEER, December, 1927. Volume 31. No. 12. Published monthly by TELEPHONE ENGINEER. Publication Office, 236 N. Clark St., Chicago, Ill. Subscription price $2 a year in the U. S. Entered as second class matter June 6, 1922, at the Post Office at Chicago, Ill., under act of March 3, 1879.

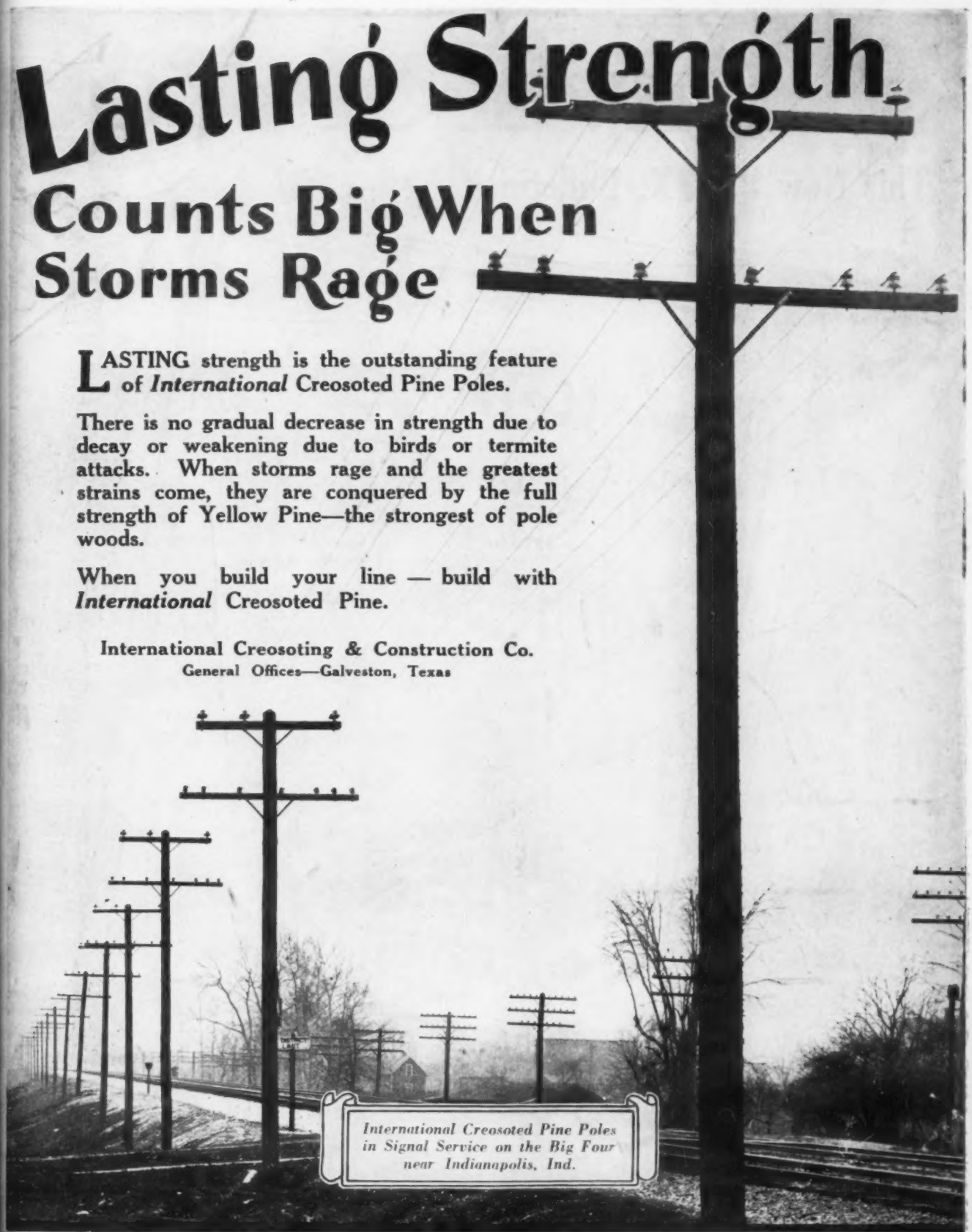
Lasting Strength Counts Big When Storms Rage

LASTING strength is the outstanding feature of *International* Creosoted Pine Poles.

There is no gradual decrease in strength due to decay or weakening due to birds or termite attacks. When storms rage and the greatest strains come, they are conquered by the full strength of Yellow Pine—the strongest of pole woods.

When you build your line — build with *International* Creosoted Pine.

International Creosoting & Construction Co.
General Offices—Galveston, Texas

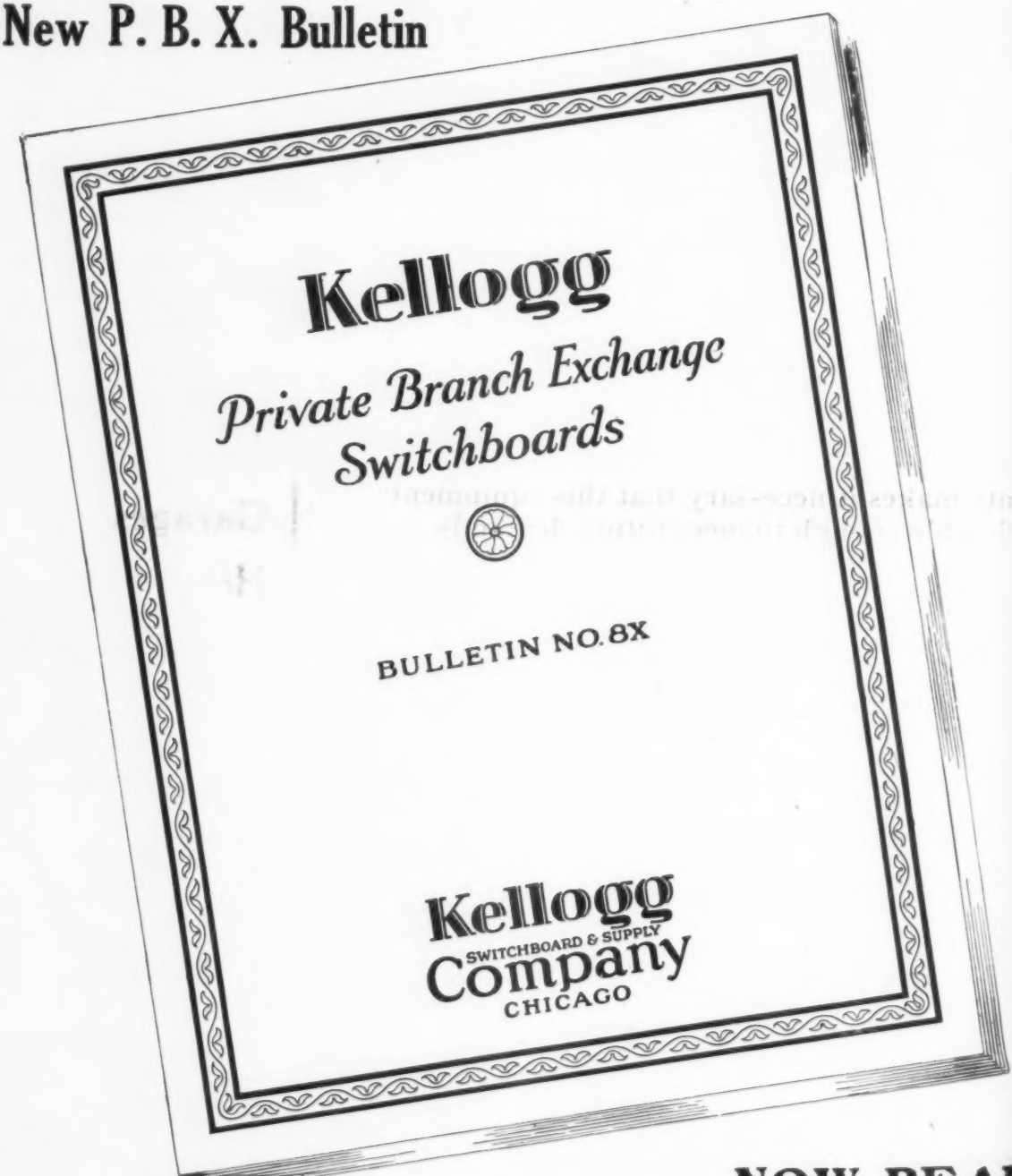


International Creosoted Pine Poles in Signal Service on the Big Four near Indianapolis, Ind.

International Pressure Creosoted Yellow Pine Poles

DEVELOP YOUR

This New P. B. X. Bulletin



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Branch Offices and Warehouses:

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163 N. Fourth St.

KANSAS CITY, MISSOURI
308 W. 6th St., Traffic

P. B. X. BUSINESS

Kellogg Ready To Help

The rapid growth of various commercial industries in every section of the country places a constant demand on the telephone executive for fast, reliable and efficient telephone service.

Nearly every community in your territory has or is contemplating a new hotel, school, hospital, factory or club that will require inter-office or inter-departmental telephone service. The natural growth of these same establishments makes it necessary that this equipment be flexible enough to meet future demands.

In keeping with this progress the Kellogg Company has designed a complete line of Private Branch switchboards that are flexible enough to meet all present requirements as well as future demands of such establishments.

Have you made a survey of your territory to ascertain how many business places have outgrown their present telephone facilities? In many such places a P. B. X. will prove profitable to both the telephone company and the patron.

To help you in developing this highly profitable business—we have prepared our No. 8-X bulletin showing a complete line of Kellogg P. B. X. equipment of every size or type to meet every requirement.

Banks
Business Offices
Clubs
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A Versatile S

Stromberg-Carlson
Junior
Multiple
Switchboard

Stromberg-Carlson Junior Multip
Switchboard Installations

Furnish modern service at low cost

Effect substantial savings in the cost of telephones

Reduce expense of dry cells

Supply fast and acc service

Permit close superv

Provide uniform tr

Increase operator e

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Stromberg

e Switchboard

The versatility of the Stromberg-Carlson Junior Multiple Switchboard brings the smaller community a metropolitan telephone service.

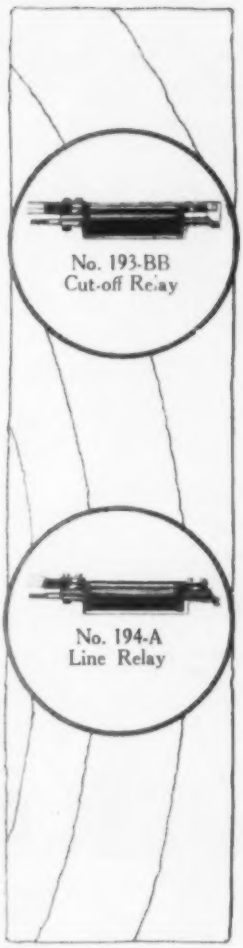
This board is so arranged that it makes no difference to the operator whether the call originates on a central energy line or on a magneto line—in each case the call is handled in the same way by the same operation.

Incorporated in the design of the Junior Multiple Switchboard are only the well tried basic principles of switchboard construction.

All features which make for intricacy in operation and maintenance have been eliminated.

This switchboard is being used successfully for the replacement of magneto plants and the revision of obsolete central energy equipment in exchanges operating less than 600 lines.

Let us send you an illustrated bulletin showing how the Stromberg-Carlson Junior Multiple Switchboard will improve your service.



Write for Bulletin 135

Stromberg-Carlson Telephone Mfg. Co.

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Southern Representative
Scoville Mercantile Company,
Atlanta, Ga.

...g-Carlson

TELEPHONE ENGINEER

236 N. Clark St., Chicago. Telephone, STAte 3161

No. 12. Published Monthly by 1927
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Established 1857 Chicago Ill USA

Pliers *Belts*
Tackles *Climbers*
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Safety Straps
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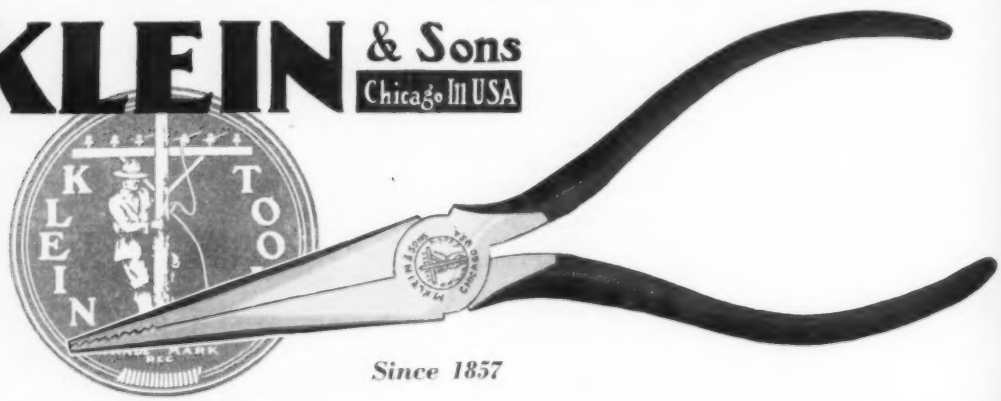

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Wind Shield Insures Efficient Operation in all Kinds of Weather.
Patented Large Non Heating Valve Wheel
Removable Burner Block. Orifice cannot be enlarged
Patented Furnace Type Burner. Greater Heat and Continuous Operation
Easily Removable Needle Cleans Burner Orifice Every Time Valve is Opened or Closed
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Three Thicknesses of Steel Where Greatest Wear Takes Place

LOOK INTO THIS NEW WALL

DREADNAUGHT

This new steel torch combines all the advantages of the time-tried older Dreadnaughts with a number of improvements. Built for heavier work, to give a bigger, hotter flame. New burner cleans itself automatically. All joints brazed with hard brass spelter solder; every torch tested. Can be used in all kinds of weather. A better "service with safety" torch that has been adopted by many of the largest public utility companies. Let us tell you more about the new Dreadnaught No. 41.

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COLUMBIA
TRADE MARK REGISTERED
GRAY LABEL
DRY CELL
FOR TELEPHONE
SERVICE
This dry cell combines both quality and service to the highest degree. Its quick recuperative power guarantees the greatest efficiency, reliability and long life for telephone use
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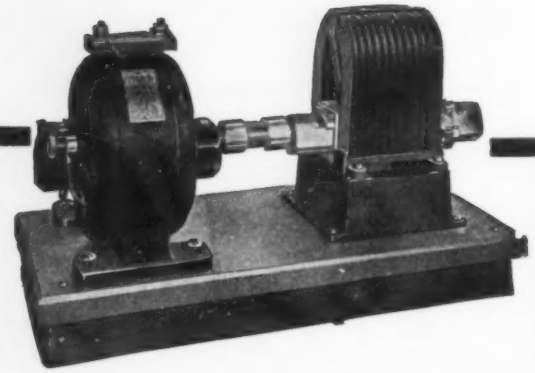
ATLANTA, CHICAGO,
KANSAS CITY, LONG ISLAND CITY
MADE IN U.S.A.
POSITIVE TERMINAL IN CENTER

LABORATORY test results on Columbia Gray Label Telephone Dry Cell economy surprise everyone who sees them unless they have used these surprisingly long-lasting batteries. So we suggest just this: Order a barrel and put them in service. Let them prove for themselves that their longer shelf life means less cost per month of service. Fahnestock spring clip binding posts at no extra cost.

Manufactured and guaranteed by

NATIONAL CARBON COMPANY, Inc.
New York San Francisco
Canadian National Carbon Co., Limited, Toronto, Ontario

Columbia
Telephone Batteries
Best by test—they last longer



Holtzer-Cabot

MAGNETO—RINGING—MOTOR—GENERATOR

Gives Better Ringing Service

Does away with troublesome batteries. Operates from a lighting circuit. Does not interfere with radio reception. There is nothing to get out of order. A few drops of oil occasionally is all the attention needed.

Write for specifications.

The Holtzer-Cabot Electric Co.

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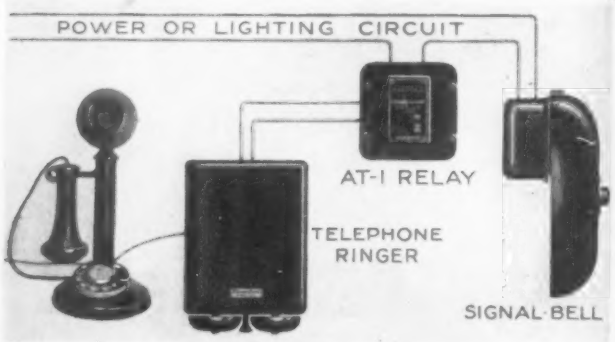
6161 So. State St., Chicago, Ill.

Loud Ringing Telephone Extension Set



For use where ordinary telephone bell is not loud enough to assure PROMPT answer.

SIGNAL

ENGINEERING & MFG. CO.

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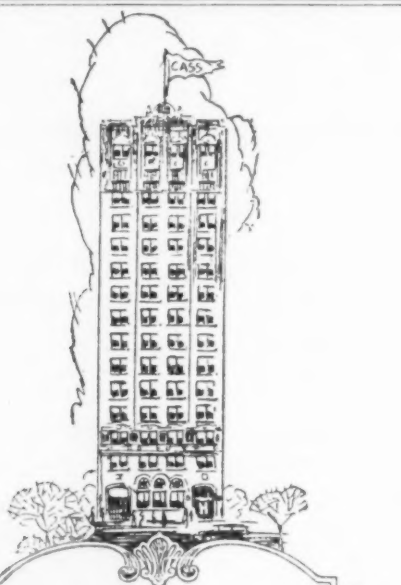

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644 CASS CHICAGO

Rates—$2.25 & Up

210 Outside Rooms with Bath

H. G. PHILLIPS, Manager

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Double Galvanized

Telephone and Telegraph Wire

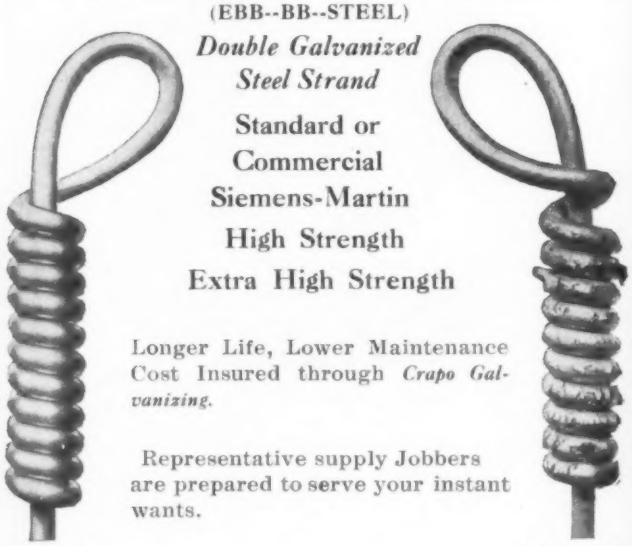
(EBB--BB--STEEL)

Double Galvanized Steel Strand

Standard or Commercial
Siemens-Martin
High Strength
Extra High Strength

Longer Life, Lower Maintenance Cost Insured through *Crapo Galvanizing.*

Representative supply Jobbers are prepared to serve your instant wants.



Galvanized by Crapo Process

Galvanized by Old Process

Indiana Steel & Wire Co., Muncie, Indiana

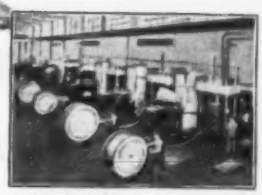
Telephones and Troops

both need behind-the-line support

BACK of the front line soldier there must be a vast machinery of supply. And back of the telephone there is a vast machinery of supply—buying, making, distributing the materials and equipment essential to Bell Telephone service.

To carry out this responsibility Western Electric covers the globe with its purchasing activities, operates the world's largest telephone factory and maintains a nationwide service of distribution from thirty-four telephone supply warehouses.

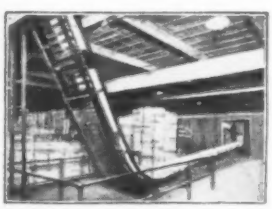
This work involves buying some 8,000 materials from Asphalt to Zinc, and making some 110,000 separate piece parts for telephones and for all that behind-the-telephone apparatus which constitutes ninety-eight percent of the total equipment.



Behind the lines at the great Western Electric cable shop.

Some idea of the men behind the machines behind the lines.

'Way behind the lines—selecting materials from far corners of the earth.



Backing up the telephone with a reliable service of supply.

Back of your telephone

Western Electric

SINCE 1882 MANUFACTURERS FOR THE BELL SYSTEM

Announcing— the Highway Earth Boring Machine

Bores the Hole--Sets the Pole

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The machine mounted on a Fordson or International Harvester tractor, equipped with crawlers, negotiates steep grades and swamps and easily reaches ninety percent of all locations.

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EDGERTON, WISCONSIN

Vacuum Grip REG. U.S. PAT. OFFICE **PLIERS**

Over Half a Million in Use

For the Lineman and Switchboard Mechanic

Correctly designed, beautifully balanced pliers with perfectly aligned cutters, deeply milled teeth and smooth-riding joints. Forged from electric furnace tool steel. Individually hardened and tempered—NOT CASE-HARDENED.

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No. 196—Long needle nose. Gets a tight grip in the hard-to-get-at places. Length 6½ in., price $1.85. No. 96—6½ in. (without wire cutters), $1.50. No. 96-RT—has sleeve twisters in jaws, $1.90. Also furnished in 7½ in. sizes.

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DEPENDABILITY and long life are the two essentials in a contact point. This "heart of the machine" should function evenly and steadily over long periods of time—it should not need replacement at frequent intervals.

Baker Contact Points are made with this principle always in mind and the name "Baker" assures that perfect performance, without constant renewal, which is the outstanding characteristic of a *good* contact point. Our contacts are made of Platinum, Iridio-Platinum, Silver and Special Alloys. There are sizes and types for all purposes.

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54 Austin St., Newark, N. J.
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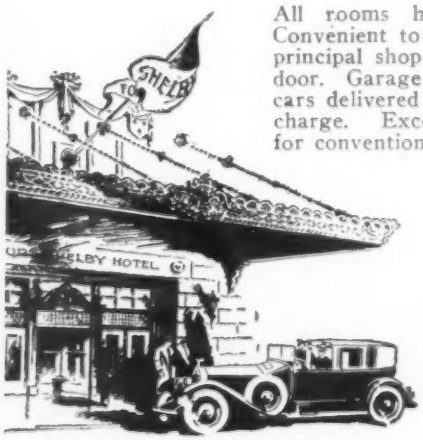
LAFAYETTE AND FIRST DETROIT

WHETHER your choice be one of the many very comfortable rooms at $2.50, $3 or $4, or one of the richly furnished suites in the 22-story recent addition, whose sunny bay windows give an entrancing view of city, river and Canadian shore, you will enjoy a special sense of value in Hotel Fort Shelby.



All rooms have Servidors. Convenient to all downtown; principal shops almost at the door. Garage in connection; cars delivered without service charge. Excellent facilities for conventions.

Brochure on Request.

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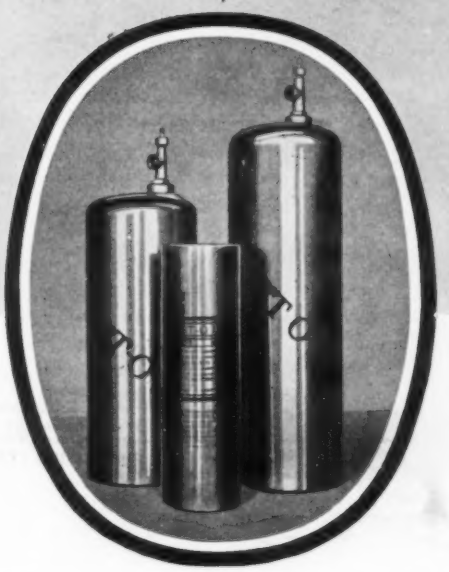
FOR EVERY SOLDERING JOB



The Prest-O-Lite blow torch attaches to any of these Standard Prest-O-Lite Gas Tanks

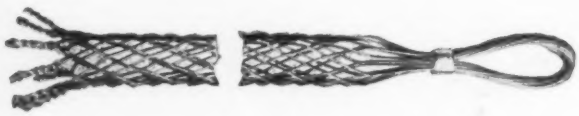
This modern blow torch avoids the delays and dangers of liquid fuel

Public utilities of all kinds are giving preference to the Prest-O-Lite blow torch because of its greater speed and economy. Interchangeable heads give superior results for every operation where soldering and brazing are required. ***For complete information, address***

THE PREST-O-LITE COMPANY, *Inc.*
New York INDIANAPOLIS San Francisco
In Canada, Prest-O-Lite Company of Canada, Ltd., Toronto, Ontario
Unit of Union Carbide and Carbon Corporation

Reliable New Specialties

Reliable CABLE GRIPS



Aerial Cable Pulling Grips made longer than the old standards—do not catch in the rings—last longer.

No.	For Cable Diam. Inches	Length Over all	Weight Each
610	¾ to ⅞	40¾	7 oz.
611	1 to 1⅜	42½	½ lb.
612	1½ to 1⅞	43	¾ lb.
613	2 to 2⅜	43½	1½ lbs.
614	2½ to 2⅞	42½	1¾ lbs.

Underground Cable Pulling Grips of great strength and toughness—cast steel wires—two-ply—with brazed ends will outlast a dozen ordinary underground grips.

No.	For Cable Diam. Inches	Length Over all	Weight Each
710	3 to 3⅝	55	2½ lbs.

Reliable TESTING CLIPS

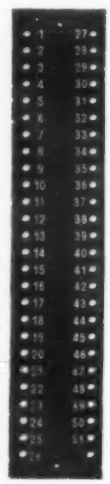
For piercing insulated wires.

Made of heavy nickel silver with hard sharp spikes—excellent workmanship.

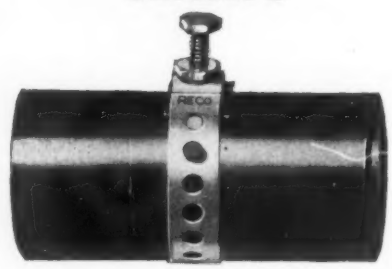
Reliable FIBRE TEST BOARDS

Numbers that you can read.
Numbers that will not wash off.
Standard numbering:

No. 810	1- 51	No. 822	607-657
No. 811	51-101	No. 823	657-707
No. 812	102-152	No. 824	708-758
No. 813	152-202	No. 825	758-808
No. 814	203-253	No. 826	809-859
No. 815	253 303	No. 827	859-909
No. 816	304-354	No. 828	910-960
No. 817	354-404	No. 829	960-1010
No. 818	405-455	No. 830	1011-1061
No. 819	455-505	No. 831	1061-1111
No. 820	506-556	No. 832	1112-1162
No. 821	556-606	No. 833	1162-1212



Reliable STATION GROUND CLAMPS



For telephone, radio and signal circuit station grounds.

Tinned copper strips—close fitting threads—excellent workmanship.

Reliable Electric Company

Mfgrs. of Telephone, Switchboard and Cable Protection

3145 Carroll Avenue **CHICAGO, ILLINOIS**

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Perfected TELEGRAPH TELEPHONE Wire

Perfected Strand

We announce the perfection of our new process of tight zinc coating that is *smooth*, deeply laid and *naturally flexible* as the wire.

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"Extra BB" "BB" and "Steel"

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MEMPHIS.....
..Union and Planters Bank Bldg.
NEW YORK....30 Church Street
BOSTON ....185 Franklin Street
PITTSBURGH ....Frick Building
PHILADELPHIA Widener Building
ATLANTA....101 Marietta Street
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DALLAS ... Praetorian Buildin
DENVER
First National Bank Bldg
SALT LAKE CITY
Walker Bank Bldg

UNITED STATES STEEL PRODUCTS COMPANY, San Francisco, Los Angeles, Portland, Seattle

COOK
X-16
Cable can be brought from top or bottom of terminal by simply reversing cover.
Bracket fits any pole, no gaining. Terminal is made so no water can stand behind it.

Cook X Type All-Steel Unprotected Terminal.

THE terminal box and bracket are formed of separate pieces of steel, riveted together and hot dip galvanized. The same process with which all good pole line hardware is treated.

The hood is drawn of heavy sheet zinc and makes a snug fit to the box.

The terminal may be mounted with cable stub carried out of either top or bottom, as the hood is reversible.

The face plate is of selected hard maple, kiln dried and impregnated in linseed oil. Sturdy studs of tinned brass, widely spaced, are inserted into the maple so that they cannot be turned.

Insulated metal fanning strips provide for orderly distribution of drop wires and lock with formed metal cross pieces which close the ends of the face plate, brace the sides of the box, and hold the face plate down tight.

The X Terminal is made in 11, 16, and 26 pair sizes.

The Type X Terminal with its wide spacing of studs, its reversible cover, accessible drop wire arrangement, its light durable construction, found instant favor among telephone managers. Hundreds of telephone companies are now installing X Type Terminals. Circular on request.

COOK ELECTRIC COMPANY 2700 SOUTHPORT AVENUE CHICAGO, ILLINOIS

Telephone Engineer

Voume 31 DECEMBER, 1927 Number 12

When Ideals Bump Into Economics

The other day we drove up Duck Creek, one of those water courses that never has reached the dignity of a place on the map, but which for hundreds and perhaps thousands of years has been tumbling down its rocky bed in a cleft between hills along one of our great rivers. The road along the creek while solid enough due to the plentiful local supply of rock was scarcely built for speed. No modern, low hung, high powered car could ever get over its ruts and bumps, although the hardy Ford of the now obsolescent Model T negotiated it fairly well.

Tillable land is at a premium as the small fields of corn, wheat and alfalfa show but pasturage on the hillsiles is plentiful and well used for dairy cattle. Houses and farm buildings are small but the tiny patches of lawns and the now withering flower gardens show the loving care that has gone into making homes even in this unfavorable country.

Along the creek ran a telephone line that interested us. A single wire was supported by a bracket nailed to a tree, there swung between two trees on a knob supported by a cross wire, now held by a native pole and then for a ways merely lying along the top branches of the brush that grew along the roadside.

We wondered that service could be given over such a line, and when we reached our destination we inquired of the farmer as to the quality of his service. His reply was that the service was good except in wet weather, when it was difficult to call the exchange or any but near neighbors. In response to his invitation we tried a call to the exchange and found transmission fairly good in spite of the line conditions we had seen.

Finding our host in the talkative mood not unusual among those who live in isolated places where the opportunity for conversation is not great, we went into a discussion of telephone service. The old man—for it seems that all of the young folks have left that part of the country—agreed that it would be fine to have the type of service we described but, he explained, "I'm afraid most of the folks here couldn't afford to pay what it costs. You know we don't have much money; only a little from the eggs and milk. Maybe it would be better to have the kind of service we get and have everybody in the neighborhood have a telephone than to have higher priced service which only a few could afford."

There are hundreds of Duck Creeks in the country, even if not on the map. They constitute a real problem in reaching the ideal, of a universal telephone service where anyone anywhere can talk to anyone anywhere else. The problem is not alone one of wires and cables, of repeaters and loading coils but is also one of placing a service of the type required for universal connection into the homes along Duck Creek at a price which the dwellers in those homes can afford to pay.

Somehow, we came away from the interview with a feeling that perhaps the company furnishing the service in spite of its obvious shortcomings, perhaps had chosen the better way for a beginning; that it is better to follow the ideal of a service universal in the local community before trying to reach the larger ideal of a service that is universal throughout the entire country. The latter can come when the economic questions involved are nearer solution.

Our Yearly Sleet Editorial Appears

At this time of year it is customary to comment on the necessity for preparedness for the sleet storms that annually or oftener visit the northern half of the country and occasionally extend their path of destruction into the warmer southern section. We approach the annual duty with a certain sense of the futility of such comment, for no amount of editorial thought and language will have any effect upon the frequency and intensity of the storms. Likewise it sometimes seems that the effect upon telephone companies is almost as little as upon the weather itself.

When the news reports of the damage from sleet storms begin to come in, it will seem to us that they will not differ much from the reports that have

come each year as far back as we can remember. However, there is hope, for it seems that each year the length of time of total paralysis of telephone communication after a severe sleet storm is being shortened. If we can not prevent damage entirely, we are learning ways of reducing the amount and of restoring service more quickly after the storm.

We have learned that the best insurance against damage is to build our line strongly and close to the ground. A line built of stocky poles set close together and only high enough to give safe clearance suffers little compared to the old lines on high poles. Next to adequate strength of lines we need adequate stocks of materials, particularly poles and wire, so that the work of restoration of service can be carried on without the delays that are bound to occur when transportation agencies as well as communications are struggling against the elements.

Bell Gives Subscribers Some of the "Melon"

For several months there has been talk of a "melon" in American Telephone and Telegraph stock. This gossip was quite effectually stopped by the declaration of President Gifford at the meeting of Railway and Public Utility Commissioners that the policy of the system was opposed to melons. More effective even than President Gifford's statement was the actual "melon" that was cut on December 1, not for the stockholders but for the users of service.

Only fourteen months ago, a material reduction in long distance rates was made and now comes another cut which affects the longer haul calls. Apparently, the earlier reduction had the result of increasing traffic more than enough to offset the reduction in revenue per call as reported earnings for the year are as favorable as for last year, nine months of which were the result of the old rates.

It is not possible at this time to estimate the effect of the change in rates on toll revenue of the parent company as the figures for earnings do not segregate various classes of income, but reports seem to indicate that there has been a marked increase in the number of long distance calls. We know of one connecting company of the Bell System that has experienced an increase of about 20 percent in the number of calls delivered to the long lines with an increase of 5 percent in gross revenue and others report similar conditions, although they do not have definite figures.

As we have said in previous comments, the stockholders of the A. T. & T. Co. have been treated very generously and they are not in need of "melons" to make up for lean years. The declaration of dividends to the public in the form of reduced rates will, in the long run, be of more benefit to the stockholders than a melon in the form of a stock dividend or other distribution.

A Lesson from Farm Price Pyramiding

In 1920, B took an option on A's farm in a central state, which option B later sold to C at an advance. C took the farm, paying some cash and giving first and second mortgages. He later sold to D at a profit and D found a buyer in E, who moved onto the farm and began to operate it. E is still on the farm which is no longer the neat, well-kept place that A had, but is a run-down ramshackle place. He is farming with the same old machinery he had in 1920 and his buildings and fences have deteriorated because it has taken every cent that the farm has earned to pay interest and taxes.

Now that the era of telephone speculation has passed into the second stage of resale at a profit to the original purchaser of the properties which have been purchased, we are wondering if the pyramiding of prices will go on until we have a recurrence of the situation in farm lands. It is to be hoped that reason will prevail before such a condition is reached.

Utilities Grow Ahead of Their Communities

"A company like the Michigan Bell Telephone Company does not grow with the community but ahead of it," are words reported to have been said by B. H. Comstock, president of the Traverse City Chamber of Commerce on the occasion of the laying of the cornerstone of a new telephone building in that city. This compliment may be taken as having wider application than alone to the company mentioned by name, for it may be said of the entire telephone industry, both as to its relation to the growth of the local community and to that of the country as a whole.

Telephone engineers and managers are planning not alone for the service that will be required tomorrow but for that service that will be needed in five, ten or twenty years. The entire business has been built upon the policy of furnishing service when and where it is needed and of a quality that more than adequately meets the needs of the user.

It is true that there have been times when this policy has had to be abandoned temporarily, as was the case during and immediately after the war when materials and men were needed in other ways and the normal increases in plant could not be made. This condition has now been remedied as plants have approached a normal amount of spare facilities.

In perhaps a few cases, inadequate financing or inefficient management have prevented full compliance with this policy of the industry, but as a whole the industry has a right to be proud of its record growth ahead of the communities and the country which it serves.

Practical Suggestions for Plant Valuation

By CHARLES W. McKAY, M. E.*

CHAPTER VI

In the last installment the subject of subscribers station equipment was discussed, briefly, and it was intimated that this discussion would be continued in the December installment, together with a tentative form for assembling the data. It will be remembered that it was also suggested that it is out of the question to make a detailed count of all of the items falling under the group of accounts which are known collectively as Subscribers Station Equipment. Again, it was intimated that a ten or fifteen per cent field check is usually considered sufficient and that this check is merely made for the purpose of gaining an idea of the proportion of various types and makes of instruments existent throughout the plant, and also for the purpose of assembling such data as may be pertinent to the building up of the unit costs for station installations, drop wires, etc.

For this purpose, I have prepared a field form—as illustrated in Fig. No. 7. Referring to this form, it will be noted that the first two columns refer to the station apparatus, Account 231. The next six columns refer to the drop wire. Drop wiring is really a part of exchange aerial wire, Account 243, and should be so classified in the actual inventory. For purposes of convenience, however, data referring to the drop wire can best be obtained in connection with the percentage station check, and the drop wire has therefore been included in the form above referred to. Of course, the information assembled—as to drop wires—is, subsequently, used primarily in connection with the building up of the unit costs. In other words, the numbers of drops are not actually counted—rather, this information is taken from the subscriber installation records, making due allowances and adjustments for two or more party lines in one house, which are served by the same drop, and also for usable dead drops which are left on vacant property with the idea that the premises will be reoccupied at an early date, and the drop again used.

In connection with the subscribers station equipment and drop wire, the following points should be carefully noted by the field inspector:

Instruments—

Make of instrument—Stromberg-Carlson, Kellogg, etc.

Manufacturer's code number, if any.

Type of instrument—long-back wall, hotel type, or desk set.

Condition of instrument.

Interior Wiring—

Gauge and type of wire used.

Length of wire.

Kind of ground wire used.

Length of ground wire.

Size and type of ground rod.

Amount and kind of miscellaneous material used, such as protectors, knobs, staples, connecting block, etc.

Condition of interior wiring.

Drop Wiring—

Type of wire used, whether No. 12 bare wire, No. 14 copper twisted-pair, No. 14 weatherproof single wire or No. 17 copper-clad steel twisted-pair.

Length of drop, from subscriber's house to nearest point of attachment on pole line.

Amount and kind of miscellaneous material, such as knobs, wood brackets, Philadelphia brackets, etc.

Condition of drop wiring.

The purpose of these data, it will be remembered, is merely for use in ascer-

MATERIAL AT SUBSCRIBER'S STATION — SHEET NUMBER ____

SUBSCRIBER'S STATION		DROP WIRE			BRACKETS				INSIDE WIRE	GROUND WIRE	LOOM	GR'D. ROD	PROTECTORS	PORC. TUBES	RINGS	TOOTH BKTS.	STAPLES	TACKS	PORC. KNOBS	SCREWS	CONDITION PERCENT
		BARE	#17 TW. PR.	(MISC)	WOOD 12"	CORNER	IRON	PORC.													
NUMBER	KIND	FEET	FT.	FT.	No.	No.	No.	No.	FT.	FT.	FT.	No.	No.	No.	No.	No.	#	#	#	#	
3	KELLOGG DESK	X	150	X	1	1	X	1	50' 2.8	✓	10	6'	✓	2	10	1	100	10	3	5	90%
etc.																					

APPRAISAL OF THE BLANK TEL. CO.
BLANKVILLE, ILLINOIS

	NAME	DATE
FIELD WORK	J. J. D.	11/28/27
APPROVED BY	C. W. M.	11/29/27
COMPILED BY	H. G.	11/30/27

(Fig. 7)

*Consulting telephone engineer, 448 Wrigley Building, Chicago, Illinois.

taining the average conditions existent throughout the plant, as an aid in the subsequent compilation of the unit costs. The total number of instruments and installations will be determined entirely from the records and the total number of drops, either from the records or in connection with the inventory of exchange aerial wire.

It will be noted that a sample of the method of recording is given on the first line of the form. In this case, there are three instruments—all Kellogg desk sets; the drop wire is No. 17, copperclad steel twisted-pair, and the length is approximately 150 ft. from the nearest pole to the point of entrance to the house; one wood bracket, one corner bracket and one porcelain knob are used; the inside wiring consists of 50 ft. of "O. G." (olive green) wire; 10 ft. of circular loom is used; two porcelain tubes (at the point of entrance to the building); station protectors are used and the miscellaneous equipment consists of 10 rings, 100 staples, 10 wire tacks, 3 porcelain knobs and 5 screws. It is further found that the subscriber's apparatus; the drop wire and the installation is in excellent condition—90 per cent.

With respect to the station installations, Account 232, it may be well to quote the instructions of the Interstate Commerce Commission: "This account should include the cost of installing apparatus and the cost of inside wire, that is, the wires (or cables) from the instruments to the point of entrance to the building, where the drop wires or interior block wires terminate; or to the junction boxes, where the house cable or other cable terminates, including wires on the same premises to connect main and extension stations; or to connect the private branch exchange distributing frames with their terminal stations."

The method of appraisement of the equipment falling under the heading of "Station Installations" has been previously outlined in detail under the head of "Station Apparatus, Account 231."

To avoid confusion it may be well, at this juncture, to give a recapitulation of accounts with the proper titles and account numbers incorporated in this recapitulation. Such a set up is illustrated in Fig. No. 2.

Referring to the above table, it will be noted that Interior Block Wires are classified as account 233. The interior block wires are, in reality, a part of the outside plant. As a matter of fact, they are merely a substitute for drop wires—being used along building wires and rear fences in conjunction with interior block cable. Block cable is used in the more conjested portions of towns and cities—in lieu of aerial cable.

To review the instructions of the Interstate Commerce Commission: "This account should include the cost of interior block wires (or cables) from the point of entrance to the building, where connection is made with the inside wires, to the point of connection with the permanent circuits at the terminals (block cable boxes) of the subsidiary underground cable or subsidiary aerial cable."

Land, I. C. C. account 211.
Buildings, I. C. C. account 212.
Central office telephone equipment, account 221.
Other equipment of central office, account 222.
Station apparatus, account 231.
Station installations, account 232.
Interior block wires, account 233.
Private branch exchanges, account 234.
Booths and special fittings, account 235.
Exchange, pole lines, I. C. C. account 241.
Toll, pole lines, I. C. C. account 251.
Exchange, aerial cable, I. C. C. account 242.
Toll, aerial cable, I. C. C. account 252.
Exchange, aerial wire, I. C. C. account 243.
Toll, aerial wire, I. C. C. account 253.
Exchange, underground conduit, I. C. C. account 244.
Toll, underground conduit, I. C. C. account 254.
Exchange, underground cable, I. C. C. account 245.
Toll, underground cable, I. C. C. account 255.
Exchange, submarine cable, I. C. C. account 246.
Toll, submarine cable, I. C. C. account 256.
Office furniture and fixtures, I. C. C. account 261.
General shop equipment, I. C. C. account 262.
General store equipment, I. C. C. account 263.
General stable and garage equipment, I. C. C. account 264.
General tools and implements, I. C. C. account 265.
Material and supplies, I. C. C. account 122.
Right of way, I. C. C. account 207.

Summary of Inventoriable Property of a Telephone Plant.

The relative number of interior block wires is usually small, except perhaps in very large cities. In the towns, and smaller cities, the interior block distribution system is used only throughout the more congested district.

The accounting instructions on the subject of block wires are slightly confusing in that they define interior block wires as the "wires (or cables) from the point of entrance to the building, where connection is made with the inside wires, to the point of connection with the permanent circuits at the terminals (block cable boxes) of the subsidiary underground cable or subsidiary aerial cable."

The writer believes that the question of including cable as block wire should be left to the discretion of the appraisal engineer. If the amount of cable is small—and it is only used as a substitute for a given number of block wires—then it should be included under block wiring, account 233.

To illustrate, let us suppose that a certain building required an 100 ft. run of ten interior block wires to provide the necessary service. It might be advisable to substitute a 10-pair silk and cotton insulated lead covered cable to replace these ten interior block wires. In such a case, the cable should be charged to Interior Block Wires, Account 233—instead of to Interior Block Cable—Account 245. In this connection it may be well to remind the reader that interior block and house cables are considered in the light of extensions to the underground cable plant and this is the reason they are chargeable to Account 245.

On the other hand, let us assume that a 200-pair cable—several hundred feet in length—is required to furnish service to a certain building, this cable extending from the terminal box in the block to the cross connection blocks in the basement of the building. Strictly speaking, if we adhere to the language of the commission's instructions, this cable should be charged to the 233 account. However, in a case of this nature, it is probable that paper insulated lead covered cable would be used, and, furthermore, the construction conditions are practically the same as those involved in placing block cable. Hence adhering to the dictates of common sense, this 200 pair cable should not be charged to Account 233, but should be charged to Interior Block Cable, Account 245.

In the inventory and appraisement of a large plant, many questions of this nature may arise and, as already suggested, they must be settled upon the basis of their individual merits—always assuming that the appraisal engineer will use good common sense in making his decisions and classifications.

It is possible, of course, to make an actual inspection of all of the interior block wiring, and to inventory this portion of the plant in detail. There is a question, however, as to whether the value of the block wire warrants the expense involved in a detailed inventory.

For all practical purposes sufficiently accurate results may be obtained by ascertaining the total number of subscribers' stations located within the district fed by the interior block cables, and actually inspecting only a large enough number to furnish data as to average conditions—gauge of wire used, spacing of bridle rings on walls, etc. Usually an inspection of 5 or 10 per cent of the total number of stations fed by interior block wiring will suffice.

Following the chronological order, the

next account we have to consider is Private Branch Exchanges, Account 234. To quote the commission:

"This account should include the cost of private branch exchange switchboards, their distributing frames, the cables connecting such switchboards and distributing frames, and the cost of installation."

Needless to say, private branch exchange equipment is costly. Hence, it should be inventoried in detail by a man who is thoroughly familiar with this especial type of equipment. Care should be taken not to confuse the cable between the switchboard and the distributing frame or box with the house cable system. The former (the switchboard cable) is chargeable to Private Branch Exchanges, Account 234, while the latter is chargeable to Exchange Underground Cable, Account 245.

Lastly, under this group of subscribers' station equipment accounts, we have Booths and Special Fittings, Account 235. With respect to this account, the commission says:

"This account should include the cost of booths and special fittings, such as desks, chairs, fans, cash registers and the cost of installation."

If this type of equipment in a given plant is standardized and the plant records are accurate, all of these data may be taken directly from the records, supplementing this transcription by a 10 or 15 per cent field check.

In many plants, however, standardization does not prevail—in other words, many different types of booths and special fittings are found. In view of the fact that equipment of this nature runs into a good deal of money it is well, in cases of this kind, to make a detailed field inventory of all of the equipment falling under the caption Booths and Special Fittings, Account 235.

We now come to a very important group of accounts, the Central Office Equipment Accounts. They are—Central Office Telephone Equipment, Account 221, and Other Equipment of Central Offices, Account 222.

Referring to the instructions of the Interstate Commerce Commission, Central Office Telephone Equipment, Account 221, includes the following:

"This account should include the cost of local and toll switchboards, chief operators', monitors' and supervisors' desks and tables, wire chiefs' testing outfits, main and intermediate frames, cables and jumper wires, call registers or meters, relay racks and coil racks, and power plants, including rectifiers, generators, engines, motors, batteries, power switchboards, meters and fuse boards; telephone and telegraph instruments and other electrical instruments and apparatus in the central office devoted to the operation of the telephone plant."

The inventory of the central office telephone equipment is necessarily a rather complicated problem. Naturally, the method followed will be largely dependent upon the size of the office and the type of equipment involved. Furthermore, work of this nature should only be undertaken by men who are thoroughly familiar with central office equipment. The apparatus involved is costly and, in some instances, a slight inventory error may result in a valuation error of several hundred, or possibly a thousand or more, dollars. May I also direct attention to the fact that only the cabling from the frames and relay racks to the board itself should be charged to Central Office Telephone Equipment, Account 221. The cabling from the main frame to the "pothead splices" should be charged to Account 244, Exchange Underground Cable.

The following extract from a recent appraisal will give an idea of the general classification of the central office equipment and of the amount of detail necessary in the inventory:

Switchboard

Type: Kellogg common battery; full multiple lamp signal, 3-position, 6-panel sections.

Capacity: Two thousand four hundred multiple subscribers' lines, 600 answering jacks (per section).

Equipment: (1) Toll section equipped with 1,100 subscribers' multiple jacks, 40 rural multiple jacks, L. D. multiple jacks, 10 special multiple jacks, 16 L. D. answering jacks, 1 calculagraph and 2 toll operators' positions. Each toll operator's position is equipped with 8 pairs toll cord circuits. Rural and location section equipped with 1,100 subscribers' multiple jacks, 10 rural multiple jacks, 50 special multiple trunk jacks, 60 rural answering jacks, 170 local answering jacks, and 2 rural and local operators' positions. Each of the rural operators' positions is equipped with 15 pairs rural cord circuits, and the local position is equipped with 15 pairs local cord circuits.

(2) Local sections each equipped with 1,100 subscribers' multiple jacks and 50 special multiple trunk jacks. These two sections are also equipped with 950 local answering jacks, 4 regular operators' positions, and 1 special operator's position. Each of the regulator operators' positions is equipped with 15 pairs local cord circuits, and the special operator's position with 9 pairs local cord circuits and 1 test cord circuit.

Description

Frames and racks: One wall type main frame equipped with 2,800 7-D fuses and mountings, 28 50-pair terminal strips.

One combination main and intermediate distributing frame Capacity: 1,600 pairs protectors, 2,000 pairs cable terminals, 1,600 pairs jack terminals. Equipment: 1,300 pairs protectors, 2,025 pairs cable terminals, 1,320 pairs answering jack terminals.

Desks: One one-position wire chief's desk; one one-position chief operator's desk.

Power Plant: One storage battery (chloride accumulator), consisting of 11 F-9 elements and 11 F-17 lead-lined wood tanks; one 50-ampere mercury arc rectifier, one power switchboard with necessary switches and instruments; one main fuse board; one service fuse board; one Holtzer-Cabot harmonic ringer converter (four frequency); four harmonic test bells; one fuse panel, capacity 360 fuses, equipped with 260 fuses and mountings.

There is such a marked difference between the various types of central office equipment that it is almost impossible to prescribe standard inventory forms. In many cases forms will not be necessary

The description of the boards, racks and auxiliary equipment may be made in list form, as suggested in the foregoing paragraphs. It is always well, however, to make a detailed diagram of the form of the board, showing relative location of answering jacks, multiple jacks, etc.

The other central office account—"Other Equipment of Central Offices, Account 222" may, perhaps, best be described by quoting the language of the Interstate Commerce Commission.

"This account," says the commission, "should include the cost of furniture and equipment (other than telephone equipment) in central offices of the operating forces. This includes the furniture and equipment in the operators' rest and lunch rooms and in the operators' schools."

Obviously, the only way to inventory equipment of this nature is to "buckle down to the job" and properly list all the furniture, fittings, etc.

We still have what is known as the "General Equipment" group. This group includes the following:

Office frniture and fixtures, account 261.

General shop equipment, account 262.

General store equipment, account 263.

General stable and garage equipment, account 264.

General tools and implements, account 265.

With reference to office furniture and fixtures, account 261, the commission says:

"This account should include the cost of desks, tables, chairs, carpets, cases, movable partitions, railings, shelves, typewriters, addressing machines, adding machines, and other office devices; stoves, portable gas and electric fixtures, and other office fittings (except fittings considered a part of the building as provided for in Account 212, Buildings, and telephone equipment provided for under Account 220, Central Office Equipment)."

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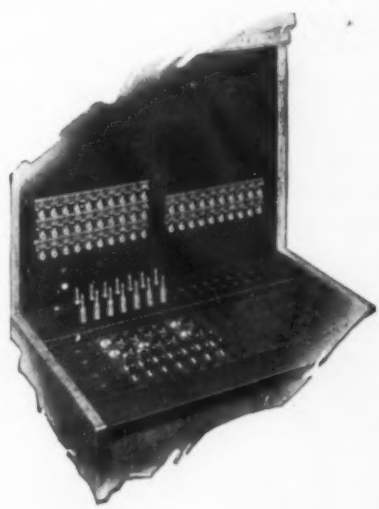

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The maintaining of normal service under abnormal conditions is the foremost requirement of a telephone system. Galvanized steel or iron wires soon rust and interfere with proper performance, often crippling an entire section.

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Copperweld wires "ride thru the storm." They stay up long after copper and (new) galvanized wires of equal and larger sizes are down. Size for size, Copperweld is 75% safer.

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Copperweld wire costs less per mile than copper or galvanized wires of equal and less safety--based on ability to withstand sleet and wind loads--weighs less, and is easier to string.

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Chicago, U. S. A.
Distributor to the Independent Telephone Trade

The inventory of the office furniture and fixtures is a comparatively simple matter. It is usually advisable to subdivide this portion of the inventory according to the location of the equipment involved, i. e., make a complete separate inventory of the furniture and fixtures in the manager's office, in the general office, in the storeroom, etc.

In this connection attention is called to the portion of the Interstate Commerce Commission's accounting instructions enclosed within parentheses. Special fittings which are a part of the buildings should be inventoried under Buildings, Account 212, and not under furniture and fixtures. Movable partitions, counters, railings and shelves should be inventoried under furniture and fixtures, while stationary railings and counters, which are obviously a part of the building itself, should be inventoried under the heading Buildings."

Referring to the general shop equipment—again, the clearest and most specific definition of what this account includes is incorporated in the instructions of the Interstate Commerce Commission. I quote therefrom as follows:

"This account should include the cost of all equipment specially provided for general shops, such as engines, gas producers, electric generators and other power apparatus used in operating machinery in such shops; machine tools, shafting, belts and like shop equipment; also such smithing equipment in general shops as is used principally for general purposes other than shoeing horses and repairing vehicles.

"Hand and other small portable tools liable to be lost or stolen should not be included herein, but portable tools and apparatus of special value may be charged to this account and remain herein so long as record is kept of such tools and apparatus."

In connection with this account, attention is directed specifically to the fact that "hand and other portable tools liable to be lost or stolen should *not* be included herein, but portable tools and apparatus of *special values* may be charged to this account and remain herein so long as record is kept of such tools and apparatus."

The next account in this group is "General Store Equipment, Account 263." With respect to this account, the commission says:

"This account should include the cost of all equipment of general store structures, such as movable counters, movable shelving and other movable equipment of like nature; carts, barrows, trucks, tools, etc., and other apparatus and appliances used in handling, storing, or packing materials and supplies.

"Counters, shelving and the like, which are permanently attached to the structure, should be charged to Account 212, Buildings, and not to this account."

In inventorying the general store equipment, it is most important that permanent counters, shelving and fixtures—which are obviously a part of the building—should be included with the cost of the building and not listed under the heading, "General Store Equipment."

The next account in the "General Equipment" group is General Stable and Garage Equipment, Account 264. With respect to this account, the commission says:

"This account should include the cost of all equipment of general stables, including horses, harness, drays, wagons, automobiles and other vehicles; equipment of shoeing shops, harness-repair shops, vehicle-repair shops, etc."

It frequently happens that a large portion of the stable and garage equipment of a telephone company consists of second-hand automobiles, motorcycles, wagons, trucks, etc. It is most important that the reproduction cost assigned to this portion of the equipment should be reproduction new, and not actual cost to the company. Many appraisers make the mistake of appraising second-hand material at the cost to the owner. This is obviously wrong and entirely inconsistent with the reproduction cost theory.

To facilitate a clearer understanding of this matter of the appraisement of second-hand equipment the following illustration is given:

A telephone company possessed of a number of second-hand Ford cars desires a 1-ton truck for material distribution purposes. It finds that by utilizing various automobile parts at hand it can build up a truck of the desired capacity at a comparatively small cost. Assuming that the 1-ton truck resulting from this make shift perfectly meets the requirements for which it was designed, the reproduction cost of the truck would be the prevalent market price of a standard truck of the same horsepower and capacity of the one in question.

The fact that the truck under consideration is a makeshift, and not the exact equivalent of a new truck of standard make, can be cared for in the determination of the present, or depreciated value.

Lastly, we have General Tools and Implements, Account 265. As I have said before, the language of the commission best describes these accounts, and hence I am adhering strictly to the commission's instructions. With respect to the foregoing, the commission says:

"This account should include the cost of portable testing apparatus and valuable tools and implements devoted to the maintenance or construction of the telephone plant, and not provided for in the equipment accounts. This does not include tools not yet in use carried as supplies unissued."

Most companies maintain a reasonable accurate inventory of the equipment falling under the tool and implement account. Such inventories, when properly vouched for by the company, or spot checked, may be accepted at their face value, providing, of course, that they are not temporarily inflated (or deflated) as of the date of appraisal.

I realize full well that this business of describing accounts affords rather "dry" reading, but it is most essential. If you are going to make an appraisal at all, you must have your property properly classified, and furthermore you must be sure to include all of the items and equally sure to avoid duplications. Hence, if you do not care to wade through all of this text now, file this copy where you can find it readily, and read the latter portion of this article when you are actually confronted with a valuation problem. I think in the long run you will thank me for this little piece of advice. It may save you much future embarrassment, to say nothing of the expense which might be involved in connection with the revamping of a completed appraisal.

The next subject we come to is a most interesting one—the determination of a reproduction cost, less depreciation, or present value.

Before taking this subject up, however, would it not be well to see just where we stand. What are we trying to do anyway, or go, as to obtain a complete valuation of your property—including "overhead costs" and "cost of establishing the business."

As long as we have finished our discussion of the inventory, and are ready to take up the subject of inspecting the plant to determine present condition, I think it would be well to recapitulate the items in a form similar to that generally used in preparing a grand summary sheet. I present such a recapitulation in Fig. No. 8.

Grand Summary of the Reproduction Costs and Present Values of the Blank Telephone Company

Classification.	Account No.	Reproduction costs.	Present value.
Right of way.....	207	$....	$....
Land	211	....	....
Buildings	212	....	....
Central office equipment 221-222		....	....
Subscribers' station equipment 231-235		....	....
Exchange distribution system.....241-246		....	....
Toll distribution system 251-256		....	....
General equipment.261-265		....	....
(1) Total inventoriable property.		$....	$....
General and legal expense during construction.....$....			$....

Engineering and general supervision during construction	....	....
Taxes and insurance during construction	....	....
Interest during construction	....	....
Omissions and contingencies during construction	....	....
Tools and tool expense during construction	....	....
Supply expense during construction	....	....
(2) Total collateral or "overhead" cost	$....	$....
(3)-(1)-(2) Total physical property	$....	$....
Cost of establishing business	$....	$....
Cost of financing	....	....
Working capital	....	....
(4) Sub-total	$....	$....
(5)-(3)-(4) Grand totals	$....	$....

Fig. 8—Recapitulation of All Values

I think No. 8 speaks for itself and no comment is necessary at this junction.

Now just a brief preamble to the subject of inspecting the plant for the purpose of determining the present condition, so that we may be in a position to start off "with a rush" in the January 1st, 1928, installment.

From previous installments, it will be remembered that what we are looking for is *accrued* depreciation and *not annual* depreciation. In other words, our problem consists in determining the expected future life of plant—regardless of age or other factors. In order to accomplish this, naturally, we must inspect the plant, item by item.

Take for illustration the equipment falling under the caption "Exchange Pole Lines, Account 241." Each pole, or run of poles, must be inspected to determine what deterioration has taken place, due to "age, wear and tear," and what the expected future life may be, basing our investigation upon the sound premises of common sense, plus experience, in the telephone "game."

Among other things, we must look for rot at or below the ground line; serious cracks or checks above the ground line; broken or rotted cross arms; the general condition of anchors and guys, etc., etc.

With respect to the aerial cable plant, we must look for crystallization in the cable sheath, defective insulation of the wires, etc.

In connection with the wire plant—if the wire be iron, we must look for rust, or corrosion. If the wire be insulated, we must take into account, the condition of the insulation as found at the date of inspection.

And so on, through the other various accounts, or classifications, of plant and equipment. I merely cite the above as a preliminary illustration—but there is no need of going into further detail now, as the subject will be discussed thoroughly in the article appearing in the issue of TELEPHONE ENGINEER for January, 1928.

As this installment will reach you before January 1, 1928, may the writer take this opportunity to express the wish that the year 1927 has more than lived up to the expectations you had in mind a year ago, and that the year 1928 will be the "best ever" in the history of your company.

Cannon Shoots Holes in "Promoters" Deals at Illinois Meet

Springfield, Ill.—George X. Cannon, re-elected president of the Illinois Telephone Association at its annual meeting held here November 17 and 18 put the buying bodies that have been so active in the telephone industry out for inspection of the convention's more than 500 attendants and showed the conventioneers what made the buying wheels go 'round. He noted that the telephone business could not be immune from the tendency toward consolidations that has been an outstanding characteristic of American business during the last couple of years, but deplored the effect of this trend on individual enterprise and its development of an absentee landlordism, particularly in the cases of the smaller companies.

There has been a tendency of these sales to create knowledge and ideas of property values that telephone men did not actually realize had existed, said Mr. Cannon. This is thrilling and encouraging to the men who have spent their lives in the industry, stated the Illinois president. In his presidential address he later referred to this factor as figuring in a necessary raise of rates in many locations. "There is no business that has been conducted on a more niggardly basis and with a smaller return, with less overhead expenses than that of the Independent telephone property," remarked Mr. Cannon in expressing the opinion that consolidation would not necessarily mean more economical operation. Introduction of new factors into the telephone field might be followed by a call for communities effected to pay a higher rate, in order that a reasonable return be paid on the purchase price or value of the purchased property, commented the Illinois leader. That would bring down criticism of attempts to gain this revenue, but since people are more critical now than they have been at any other period, the rate raisers might as well steel themselves for the ordeal and get enough money to supply good service at a good return, he continued. Eventually the improved service will reconcile the subscribers to the increased rate.

The president referred to the work being done by the association in making regulation easier for the smaller companies and called for co-operation between the association and the commission in simplifying the procedure of relief for the smaller companies. He also mentioned the new psychology of younger executives in building telephone traffic, stating that the older business men had considered the telephone as a luxury, while the newer generation considers it as one of the greatest conservers of time and energy.

Illinois Body Trail-Blazer

Jay G. Mitchell, who was re-elected secretary-treasurer of the Illinois association, reviewed the body's work during the last year and pointed out its definite value to its members. He cited a number of cases wherein the Illinois association had pioneered in establishing many of the present successful practices of state telephone associations.

Mr. Mitchell told the history of the state's district meeting and of their growing practical benefits. He related the work done by the association in staging traffic and plant conferences under the supervision of acknowledged authorities. He also detailed what the Illinois association has been going to get the telephone companies of the state to use newspaper space properly and sufficiently. What the association did in combatting the women's eight hour day bill was outlined by Secretary Mitchell. Further details of the work done for the association with respect to this matter by C. B. Cheadle and Ed D. Glandon were presented by Mr. Glandon later during the convention.

Illinois has been paying special attention to the transmission problems of its members, said Mr. Mitchell, in telling of the transmission surveys made in 87 of member company exchanges. Further particulars of the specific work of the association with respect to traffic education and standardization of toll rates were given to the convention in the secretary's report.

Mr. Mitchell recommended that every effort be made by the association and its members to establish contact with the new owners of telephone properties in the state, and that these new owners be urgently solicited to take an active part in the work of the association.

The association's financial and membership affairs were reported to be in healthy condition.

How the association's representatives skilfully avoided any misinterpretation of

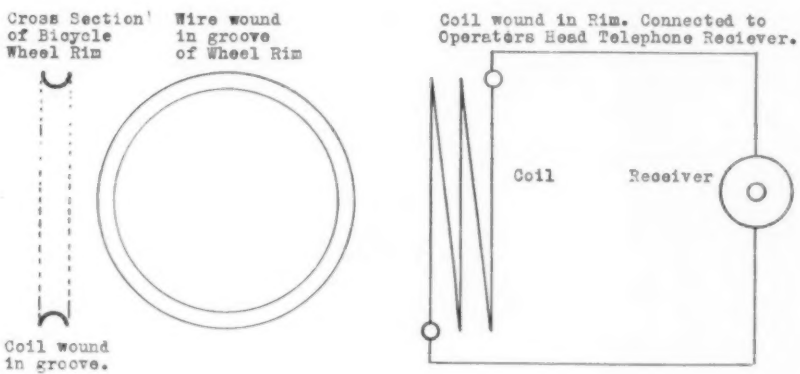
(*Continued on page* 36)

Studying Details of Telephone Work

By E. R. COLLINS
Manitoba Telephone System

CHAPTER XI

This earth on which we live is full of funny noises. If you doubt this, then a little investigation on your part will be sufficient to convince you. Wind a coal of wire in the wooden rim of an old bicycle wheel, from which all metal parts have been removed. The wire from an old ringer coil will do very well. Cover the wire with a few layers of friction tape, then give it two or three coats of black asphaltum paint to protect it. A couple of binding posts mounted on the inner side of the rim complete the job. Now with a telephone receiver connected as in Fig. 76, you are ready to start exploring. The coil you have made is called an exploring coil.


Cross Section of Bicycle Wheel Rim
Wire wound in groove of Wheel Rim
Coil wound in groove.
Coil wound in Rim. Connected to Operators Head Telephone Reciever.
Coil
Receiver

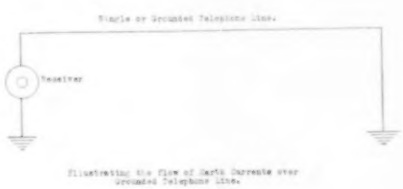
Exploring Coil made from Wooden Bicycle Rim.

(*Fig.* 76)

If you will hold the coil over the rail of the street railway system, you will hear the hum of the commutator of the motors. Try holding the wheel at different angles, and note the position which gives the loudest hum. The current flowing in the street car system sets up an induced current in the coil and receiver. What you actually hear is the interruptions caused by the brushes passing over the segments of the commutator, causing short interruptions and surges to the direct current flow. Holding the coil toward electric light lines and transformers also indicates the distance to which the magnetic field of these lines will extend.

In Fig. 77 is shown a grounded or single telephone line grounded at each end, with a receiver connected at one end. The hum in the receiver indicates that there is a transfer of electrical energy over the line. The intensity of the noise will vary for different localities. Where street car lines are operated, or high voltage lines are near, there will be quite a flow of current through the earth from point to point. This will be indicated by the noise in the receiver, and can often be detected by sensitive meters. The telephone wire offers a low resistance path for such currents, and in such localities a grounded line is not satisfactory.

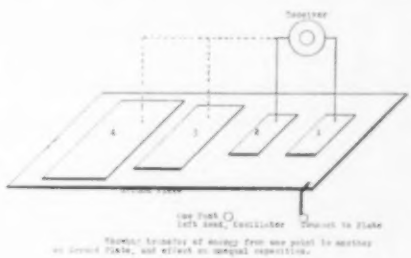
In northern Ontario, far away from any power lines, or street railway lines, some peculiar earth noises can be heard. One line in particular about 20 miles long, when grounded, would start the merriest chorus of frogs croaking one could wish to hear. The source of such noise is hard to understand.



(*Fig.* 77)

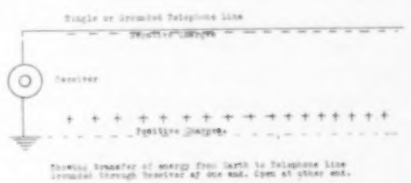
Noise Due to Unequal Capacities.

In Fig. 78 we have shown an experiment which may seem to be impossible, yet if carefully performed will be of great interest. A piece of sheet iron (the back of a metal letter file will do nicely), is laid on the table. The oscillator described in a previous issue is connected to the plate as shown, and the one terminal is left dead. Get the oscillator far enough away so that it will not induce a current in the coils of the telephone receiver. In case your oscillator is not strong enough, borrow a two-stage audio amplifier and boost it up. It will be necessary to connect a coil across the amplifier output to allow the plate current to reach the plate. Now get 4 pieces of metal as shown in Fig. 78, 1-2-3-4. Have 1 and 2 of equal size, with 3 and 4



(*Fig.* 78)

larger than the others. Lay a piece of paper over the large plate which will represent the ground. Then lay the four pieces of metal over the paper. Now connect the receiver to 1 and 2, taking care to have your hands clear of either of the plates or receiver terminals. Note that there is no sound heard in the receiver. Now move one receiver terminal from plate 2 to plate 3 and note the tone is heard. The tone is louder when it is transferred to plate No. 4. Now here is what has taken place: We will suppose



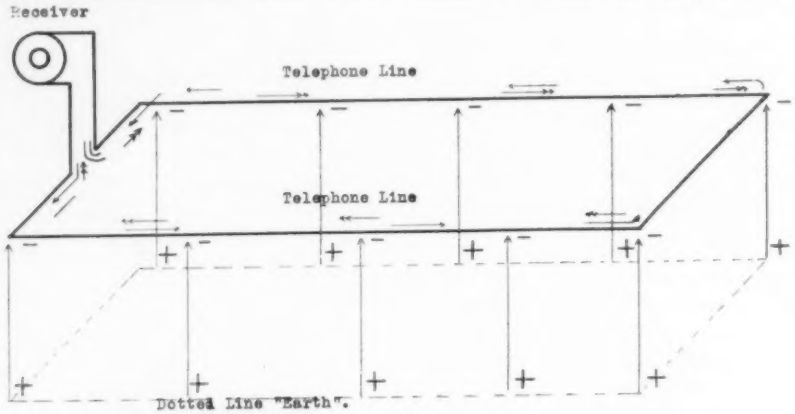
(*Fig.* 79)

for an instant that the ground has a positive charge. Necessarily, the four plates separated by the paper are similar to a condenser, so that they will each receive a negative charge. Plates 1 and 2 being of equal size and distance from the ground will have equal charges. Therefore since they are equal, there will be no transfer of energy over the receiver.

But plate No. 3 is larger than plate No. 2 and will receive a larger charge. In attempting to discharge immediately, part of its charge will overcome the charge of plate No. 1 and a transfer of

electrical energy will be evident by the hum in the receiver. Plate No. 4 being larger still will cause a larger hum. If care is taken to perform this experiment successfully, it will assist greatly in understanding the rest of this article.

In Fig. 79 is shown a telephone line grounded through a receiver at one end, but open and clear of the ground at the other. We will suppose that for a given instant there is a positive charge on the earth's surface. Then it follows that there will be a negative charge accumulate on the telephone wire strung above the earth. The charge, however, leaks off through the telephone receiver to earth again, and appears as noise. Now as noise is the great enemy of successful voice transmission, we must do all we can to avoid this condition. In Fig 78 when the receiver was connected to plates 1 and 2, there was no noise. These plates were equal, and therefore balanced. Since there was as much pressure on one side of the receiver as on the other, then there would be no flow of current evident.



Showing distribution of Charges on Telephone Line "Balanced Metallic Circuit."

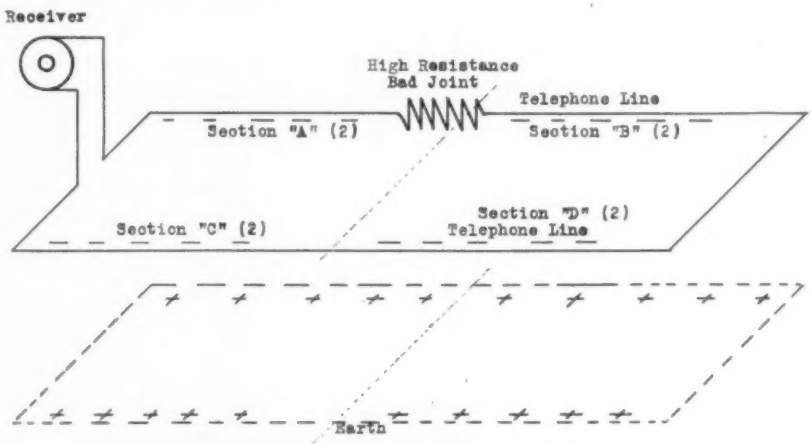
(*Fig.* 80)

Balanced Telephone Lines.

In telephone lines we must use the same means to prevent noise. That is they must be in balance. They must be the same distance from the earth, and must be the same length and size, to be equal capacity areas. If these conditions are met, they will give a result as shown in Fig. 80.

Here we have a metallic telephone line, of two equal sized wires, supported the same distance above the earth as shown by the dotted lines. We have shown the earth positive, and the line therefore negative. However, since the polarity of the charge will be rapidly reversing, then an alternating current will be caused to flow over the line wires. But since the charge on the two wires is equal, then the effect of one wire will neutralize the effect of the other, and there will be no evidence of current flow in the receiver.

In Fig. 81 we show the same line. Here we show a high resistance joint such as might appear at a railway crossing any frosty morning. Such a joint we know will make the line noisy. The line may even be open, and the noise would then be louder. We will suppose that the line is open at the bad joint. Then on one side of the receiver we have a capacity section "A" which we will give a value of (2). On the other side of the receiver we have Sections "C," "D," and "B" each with a value of (2). Therefore on one side we have a capacity value of (2) while on the other side we have a capacity value of (6) or a difference of (4). Therefore the transfer of current due to these unequal capacities, will be due to the difference of energy in the charges, which is (4). Here we have a similar situation to the experiment in Fig. 78.

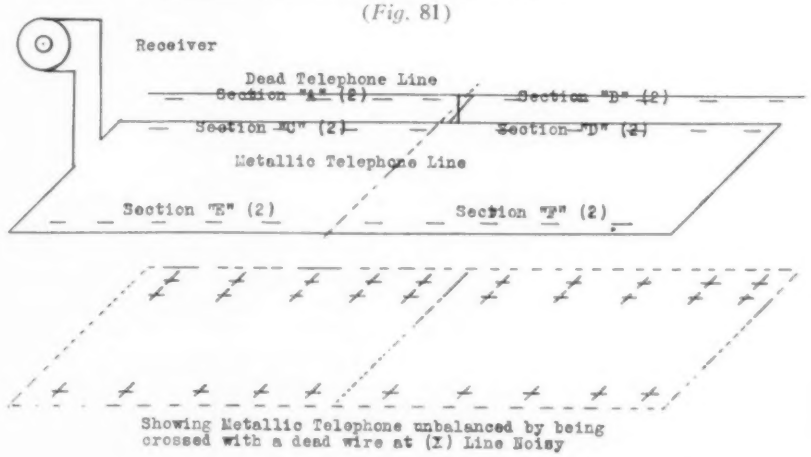


Showing distribution of Charges on Line which is unbalanced, due to bad joint. Line Noisy.

(*Fig.* 81)

Unequal Capacities Due to a Cross

In Fig. 82 we have the same line again, but this time instead of being open, it is crossed with another wire which is free from ground. We have here 6 equal capacities. On one side of the receiver we have Sections "A," "B," "C," "D," each with a value of 2 making a total of 8. On the other side we have Sections "E" and "F" each of the value of 2, making a total of 4. Now if the two wires were separated at the end of the line away from the receiver, the noise would be quite loud, due to the difference of the charges on each side of the receiver. If the lines were closed, the circuit would be much quieter, as part of the energy would go around that way. If there were a line coil at that point the impedance of the coil would prevent the high frequency hum from getting through, and the noise would be almost as loud as when the line was open. Here again we have much the same thing as in Fig. 78.



Showing Metallic Telephone unbalanced by being crossed with a dead wire at (X) Line Noisy

(*Fig.* 82)

Connecting Grounded and Metallic Lines

In Fig. 83, we have a grounded line and a metallic line connected through a telephone exchange, with a metallic pair of cords. The grounded line might be fairly quiet, and fit to talk over. When connected to a metallic line, or a long distance line which would also be metallic, we get back to unequal capacities again. Suppose we were listening at the distant end of the metallic line. Then the noise effect would be due to the difference of the capacities of the single line and the upper side of the metallic line which is 4 and the lower side of the metallic line which is 2 or a difference of 2. The greater the difference the greater the noise. The operator at the exchange would also hear the noise although listening at different points on the line would make a difference to the intensity of the noise, due to the change in the unbalanced condition to that listening point. To connect lines in this manner therefore would be bad practice.

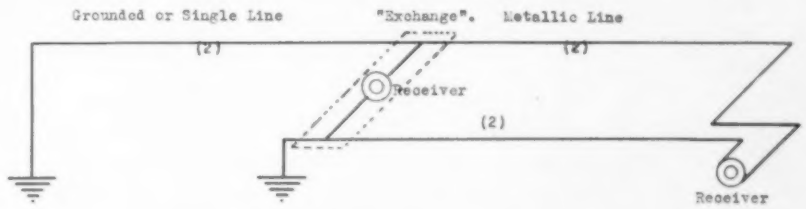
If we have a cord circuit using condensers to separate the two cords we will have very much the same situation. It will depend on the frequency of the disturbing currents. If the frequency is high then the resistance of the condensers will be very low, and the two lines might as well be connected straight through without the condensers. For low frequencies, say of the order of 20 to 60 cycles the resistance would be higher, and some blocking effect would be noticed to the noise. In Fig. 84, therefore, we have a method of connecting such lines which will depend on local conditions, or the nature of the disturbing charges.

In Fig. 85 we show the two same lines connected by a repeating coil or transformer is used in place of the condensers. This method separates the capacities, so that the noise heard will be that of the noisiest circuit, which would usually be the grounded line. This repeating coil might be connected into the grounded line at all times or it might be included in the cord circuit of the switchboard. The former method is preferred, as then at all times the grounded line can be treated by the operator as a metallic balanced line when making connections. Such a coil will introduce a certain amount of impedance to certain voice frequencies, which is known as a loss. This as a rule is to be preferred to the noise.

Connecting Balanced Metallic Lines

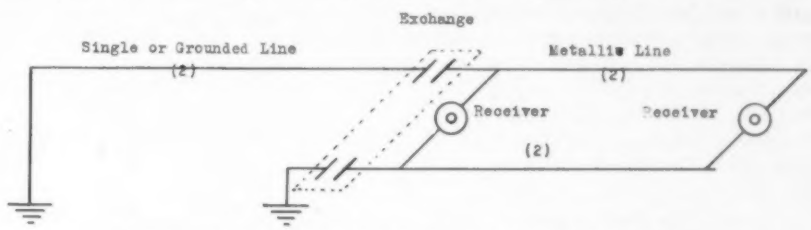
In Fig. 85 we have two balanced metallic lines which we will assume are normally quiet lines. Connect them with a cord circuit in which two unequal condensers are used. Assuming that a 1,000-cycle current were flowing, then the 1 M.F. condenser would offer a reactance of 159 ohms, and the ½ M.F. condenser a reactance of 315 ohms. The difference of 156 ohms would not be much but in certain locations the noise due to the unbalance would be bad.

(To be continued)



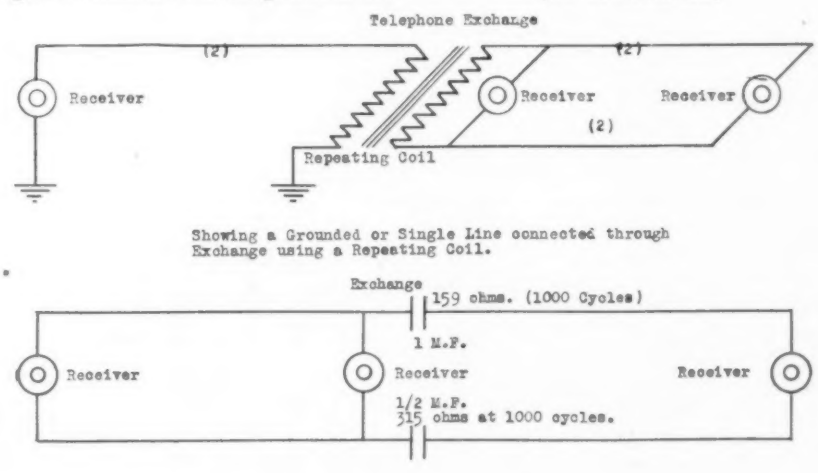
Showing a Metallic and Single Line Connected through a Telephone Exchange with ordinary Cords.

(*Fig.* 83)



Showing a Single Line and Metallic Line Connected through an Exchange, using Cords equipped with two equal condensers.

(*Fig.* 84)



Showing a Grounded or Single Line connected through Exchange using a Repeating Coil.

Showing two Balanced Metallic Lines connected through an Exchange, with unequal condensers in Cord Circuit.

(*Fig.* 85)

Engineers' Club in New San Francisco Home

San Francisco, Cal.—New quarters of the Engineers' Club of San Francisco have been dedicated. The club is free of debt and operating on a self-supporting basis.

In recent years the club has become a focal center for activities of engineering societies in the San Francisco Bay region. It is the club's plan to extend this service to the profession and particularly to effect still closer relations with national engineering societies.

Grant Pelton Now Is Automatic Director

Chicago, Ill.—Grant Pelton, for the past 2½ years vice-president in charge of manufacturing for Automatic Electric, Inc., and for 20 years a member of the Automatic organization, has been made a director of the company.

Athens, Home of Ohio Head, Orders Automatic

Athens, O.—Athens Home Telo. Co., of which Dr. C. L. Jones, president of the Ohio Independent Telephone association, is secretary-manager, has concluded its extensive investigation of equipment for its new plant by placing an order for 1,200 lines of Strowger automatic equipment.

A handsome new headquarters building is under construction to provide a home for the new equipment which will care for approximately 2,500 subscribers' stations. The order also calls for a six-position toll, rural and special board from the Automatic people.

Application of Alternating Currents in Telephony

By F. J. DOMMERQUE
Fellow A. I. E. E.

91. Transmitter and Receiver

As telephone currents are pure and simple alternating currents, it follows that all apparatus forming part of the talking circuit is subject to the laws governing alternating current phenomena. It is not in our province to discuss every piece of apparatus influenced by alternating current in a telephone plant nor its actions, but it may be instructive to select some of them which are of particular interest.

There is first of all the transmitter. The voice causes the diaphragm of the transmitter to vibrate in accordance with the wave form of the voice, which form has been discussed in Section 13 on sound waves. The transmitter is fed by a steady current which is converted into a variable current, the variations of which are sent out as electro magnetic waves. The vibrations of the diaphragm have been observed as being of a very small amplitude. To increase the amplitude an induction coil is employed, the action of which will be explained presently.

At the other end of the line the receiver transforms the variations of the electric current again into sound vibrations, which are perceived as speech by the listener.

In order to obtain an efficient reproduction of the vibrations of the transmitter diaphragm and also to prevent distortion and indistinctiveness of the reproduced speech the modern receiver has

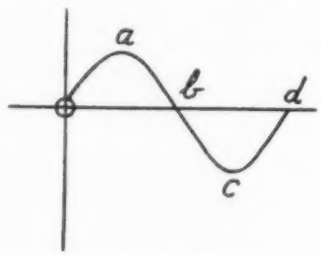


Fig. 104

been evolved, which consists of a permanent magnet whose poles serve as core for an electromagnet. This arrangement renders the telephone more sensitive to small changes in the magnetizing circuit, the magnetic field being the result of two factors, the constant action of the permanent magnetism and the variable action of the electromagnetism. During a complete cycle shown in Fig. 104, from 0 to d the diaphragm in Fig. 105 moves from position 2, the normal position, to position 3, from position 3 to position 1 and back to normal position.

Position 2 shows that in the normal position the diaphragm is attracted due to the attraction of the permanent magnet. Without the permanent magnet the diaphragm would not be attracted in its normal position and would complete a cycle during each half of the wave in Fig. 104; that is, during the half wave ob or bd in Fig. 104, therefore it would double the number of vibrations of the alternating current, which would prevent accurate reproduction of the speech. The stronger the permanent magnetism, the higher the sensitiveness of the receiver

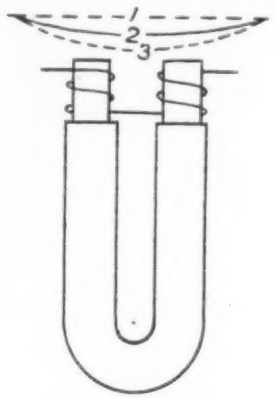


Fig. 105

will be, which means, the reproduction will be more perfect. There is a limit to this strengthening, too much of it will cause the diaphragm to "freeze," it will no longer vibrate symmetrically.

92. Induction Coils and Repeating Coils

The current fluctuating in the primary coil, containing also the transmitter, magnetizes the iron core of the coil, and the variations in the magnetic field induce fluctuating currents in the secondary circuit corresponding to the waves produced by the transmitter in form but lagging in phase by a quarter of a wave length. As a rule primary and secondary winding have nearly the same energy but the induced currents are of a higher potential and lower intensity than the primary currents and consequently better suited to overcome high line resistances and may be adapted to almost any kind of a line by properly proportioning the windings of the coil.

Graphically we may represent the current flowing in the transmitter when in its normal state and through the primary winding of the induction coil by the ordinate 1 in Fig. 106 and the voltage by the ordinate 2. As soon as the transmitter diaphragm is set in vibration the primary current and voltage commence to vary, these variations may be indicated by the curves i_p and e_p respectively. The induced e. m. f. in the secondary winding may be represented by e_s in the lower part of Fig. 106 and the current by i_s. This illustrates the difference in current and voltage from the primary; the secondary current has a much lower amplitude, it has become very small, while the fluctuations of the secondary voltage have become considerably large.

Induction coils as well as repeating coils are nothing else but small transformers; there is no very marked difference between them; repeating coils also have two windings, a primary and secondary. The principal difference consists in the ratio of transformation with repeating coils used in cord circuits for instance, where simply a separation of the two halves of the circuit is required, the ratio of transformation can be one to one, that is, both, primary and secondary can have the same number of turns. The winding of induction coils ranges from 0.3 to 0.5 ohms for the primary and from

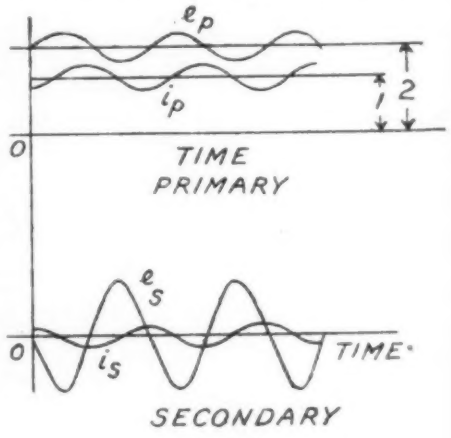


Fig. 106

14 to 36 ohms for the secondary in local battery work. For common battery work the Bell companies use an induction coil with a primary of 17 ohms and a secondary of 26 ohms.

**Twenty-first article on Telephone Mathematics and Physics.*

How many are 421,000 stockholders?

An Advertisement of the
American Telephone and Telegraph Company

On October 15th, American Telephone and Telegraph Company checks representing the 152d dividend were mailed to its 421,000 stockholders. That is the largest number of stockholders of any company in the world.

The American Telephone and Telegraph Company is owned by a great investment democracy.

Its dividend checks are cashed at banks in every state in the Union, by people representing all trades, stations and professions.

No institution is more nationally or publicly owned than the American Telephone and Telegraph Company, which in turn owns more than 91% of the common stock of the operating companies of the Bell national System. The average holding is 26 shares, and no one person owns as much as 1% of the total stock.

The Bell System was developed in the interest of telephone users and is owned by the public that it serves.

93. Retardation Coils

Retardation coils differ from induction coils in that they do not transform, but simply retard or choke back all rapidly varying currents. For feeble currents of this kind an open magnetic circuit is preferred or, better stated, is necessary. Such coils are frequently named impedance coils just because in practice they impede and block alternating or rapidly varying currents.

In composite circuits for simultaneous telegraphy and telephony the problem to be solved is such that the direct telegraph currents require a certain intensity to operate the telegraph instruments, while in telephoning weak or feeble currents must be changed from sudden increase and decrease at the opening and closing of circuits to slow increase and slow decrease. Retardation coils will answer the purpose.

To give a high impedance a closed magnetic circuit of low reluctance is required. A core of very fine wire formed into an U shape or, better, into a ring and wound with a large number of coarse wire will answer. Sometimes the particular case where such a coil is required is better served by a retardation coil with a core of continuous iron wound into a ring; such coils are called toroidal and are usually provided with an outside casing of iron.

The impedance of a retardation coil varies for alternating currents of different frequencies; it increases with increasing frequency and its value is determined by the inductance L which is a function of the number of turns and the kind of core of the coil.

To calculate the impedance of a retardation coil the formula: Impedance $= \sqrt{R^2+(2\pi n)^2L^2}$ ohm is used, where R designates the ohmic resistance or resistance to continuous currents, n the frequency of the alternating current and L the inductance. As an example we will determine the impedance of a retardation coil having an inductance L = 2 henrys, an ohmic resistance of 10 ohms and being subjected to an alternating current of 800 cycles per second. Then its impedance will be:

$$\sqrt{10^2+(2\times 3.14\times 800)^2\times 4} =$$

$$\sqrt{100+100962400} = 10{,}044 \text{ ohms.}$$

This shows the ohmic resistance (R^2) is of very little consequence in comparison to the other expression under the rootsign.

In the above example the frequency of 800 cycles per second had been chosen intentionally because it represents a fair average value of the frequencies of importance in telephonic transmission, the range of the most important frequencies being from 530 to 1200 cycles per second. Often we find the value of $2\pi n$ or ω taken as 5,000, which corresponds very nearly to 800 for n.

For sake of illustration another example may be inserted, using for n a lower frequency, say 15 cycles per second, a frequency suitable for generator current. We then find the impedance, using the values for L and R the same as before, namely L = 2 henrys and R = 10 ohms, as

$$\sqrt{10^2+(2\times 3.14\times 15^2)\,2^2} =$$

$$\sqrt{100+35400} = 188.5 \text{ ohms.}$$

Here the ohmic resistance has gained considerably in importance in comparison to the total resistance.

Examples being always instructive we will add as an example the calculation of the impedance of a condenser.

Previously the impedance of a condenser in a circuit containing resistance and capacity only, was found to be

$$\sqrt{R^2+\frac{1}{(2\pi n)^2\times C^2}}$$

This formula indicates that the higher the values of n and C, the smaller the value of the impedance will be.

Assuming again the ohmic resistance as 10 ohms, the frequency as 800 cycles per second or rather the value of $2\pi n$ as 5,000 cycles per second for easier reckoning, and the capacity of the condenser as 2 m. f. Then we have to transform first the microfarads into farads, as all values must be in the same units. To express capacity in farads the microfarads must be multiplied by 10^{-6}; hence we obtain the impedance as—

$$= \sqrt{10^2+\frac{1}{(2\pi\times 800\times 2\times 10^{-6})^2}}$$

$$= \sqrt{100+\frac{1}{\left(5000\times\frac{2}{10^6}\right)^2}}$$

$$= \sqrt{100+\left(\frac{1}{0.01}\right)^2}$$

$$= \sqrt{100+100^2}$$

$$= \sqrt{10100}$$

$$= 10.05 \text{ ohms.}$$

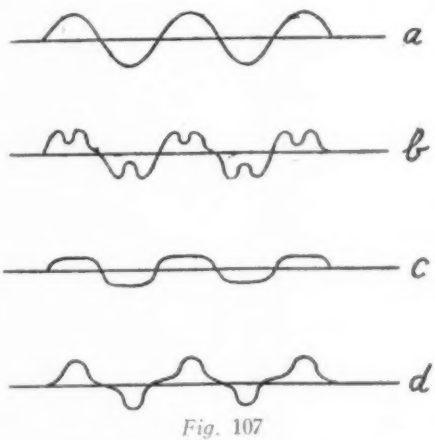


Fig. 107

94. Generator Current Curves

The efficiency of any generator depends primarily on the construction of its armature. It is assumed that the air-gap between the armature and the magnet poles is reduced to a minimum. The current curve theoretically should be a sine curve. This it would be, as shown in Fig. 107a, if the armature were made of a non-magnetic material, because then a homogeneous magnetic field could be maintained throughout the rotation. The introduction of iron, however, into the armature causes the magnetic field to change its form at every step during rotation, as shown in Fig. 108. Starting from the horizontal position (left in Fig. 108) where the armature wires cut the lines of force at right angles, during the rotation the north pole of the armature first looses its magnetism; then in the vertical position (right Fig. 108) remains for an instant non-magnetic; then becomes a south pole, and finally returning to the starting position becomes again a north pole.

The form of the current curve depends on the changes in magnetism. If the armature poles are too narrow to bridge across the gap between the pole pieces, four rather abrupt changes are observed in the magnetism which, as the induced current is proportional to the change in magnetism, gives to the current curve four decided impulses, separated by nearly currentless intervals as indicated in Fig. 107b.

If the armature poles overlap the interval between pole pieces, they can never loose their magnetism entirely and a current curve results as shown in Fig. 107c; the produced current intensity is more evenly distributed during the rotation of the armature.

In the case where the armature poles just bridge the gap between the pole pieces, the current curve assumes the form shown in Fig. 107d with three relative maxima, one when the middle of the armature pole leaves the pole piece, the second when it passes through the vertical zone and the third when entering into the second pole piece. Still this is the most favorable construction as the resulting current curve comes nearest to be a sine curve.

Standard Underground in General Cable Merger

Pittsburgh, Pa.—Properties of Standard Underground Cable Co. have been acquired and its current obligations assumed by General Cable Corp. (formerly Safety Cable Co.), which has also acquired the properties and assumed the current obligations of Rome Wire Co., Dudlo Mfg. Corp., Baltimore Sheet and Wire Co. and Phillips Wire Co.

There will be no change in the personnel of the management, which will continue the business of Standard Underground Cable Co. as a Division of General Cable Corp.

The consolidation is expected to be of advantage to each of the businesses consolidated and of substantial benefit to the entire industry, and those served by it.

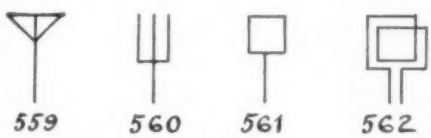
How to Read Telephone Circuit Diagrams

By DAVID S. HULFISH

CHAPTER X

Radio Telephony

The one element of apparatus specific to radio telephony and not found in other branches of the telephone industry is the antenna. Symbols for an open-wire antenna are shown in Figs. 559 and 560; for a loop antenna, in Figs. 561 and 562.

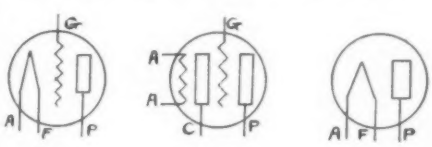


559 560 561 562

The radio telephone set uses, largely, as one of its important structural elements, an electron-relay device, called variously a "valve," "tube" or "bulb," and used in the function of detector, amplifier, oscillator or rectifier.

A symbol for the usual type of electron-valve is shown in Fig. 563. In a vacuum bulb glass are three electrical elements, namely, the hot electrode (cathode) angular in form at the left, the cold electrode (anode) rectangular in form at the right, and the controlling electrode, zig-zag in form and positioned between the other two electrodes. These electrodes usually are named "filament," "plate" and "grid," respectively, and often are designated by the letters F, P, G.

In service, when the cathode is polarized negatively and the anode is polar-



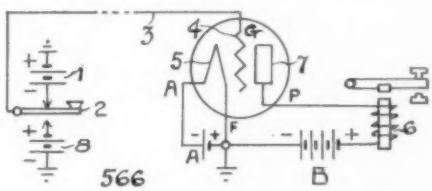
563 564 565

ized positively by connecting them to some source of electric potential (note the B battery in Fig. 566), and when the cathode or filament is properly heated, a stream of invisible electrons will pass from cathode to anode, and this electron stream offers a conducting path to the B-battery current. The function of the third electrode or grid is to modify, control or interrupt this B-battery current.

The diagram of Fig. 566 shows a system of simple structure using the value symbol of Fig. 563. This symbol is to be read as a specific form of electric relay.

The function of a relay is to associate together two circuits in such relation that the opening and closing of the second circuit may be controlled by the opening and closing of the first circuit; or, in terms more general, to associate together two circuits in such relation that the current changes in the first circuit are reproduced in the second circuit.

Fig. 566 shows a wire-line telegraph system. The "first circuit" is the line circuit from earth, through battery 1,



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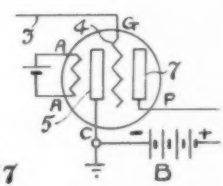


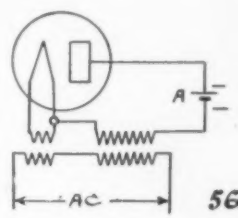
567

key 2, line-wire 3, to grid 4, filament 5 and battery A, to earth. The "second circuit" is the local circuit from battery B, through sounder 6, plate 7 and filament 5. The armature of the sounder 6 will follow the movement of the key 2 through the action of the electronic relay, as follows:

With the key 2 "up" in the position shown in the figure, battery 1 (positive to earth) has its negative pole connected through key 2 and line 3 to the grid 4, making the grid negative when compared with the earthed filament; the electron stream is suppressed from filament to plate, and B-battery current does not flow, hence the armature of the sounder 6 is "up" as is its controlling key.

With the key 2 "down," battery 8 (negative to earth) has its positive pole connected through key 2 and line 3 to the grid 4, making the grid positive when compared with the earthed filament; the electron stream is not obstructed by the grid and flows now from the filament to the plate in response to the polarization from the B battery; current flows from the B battery through the sounder 6, drawing the armature "down" to follow its distant controlling key.

Should the polarization of the plate be strong and the polarization of the grid be weak, the grid will not stop all of the current from the plate, but as the grid varies in polarization potential, so will the B battery vary in current. Thus a telephone speech current may be impressed upon the grid and the speech may

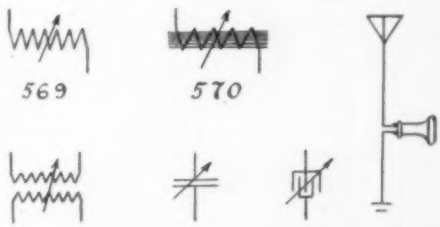


568

be heard by a telephone receiver connected in lieu of the sounder 6.

Symbols for modified forms of electron values are shown in Figs. 564 and 565. In Fig. 564 the cathode of terminal C is not electrically connected to the filament of terminals A, but is heated by radiation from the filament. For service in the system of Fig. 566, the connections would be as shown in Fig. 567. The source A of Fig. 567 may be alternating current.

In Fig. 565, there is no grid. This



569 570 571 572 573 574

symbol wyill be found in rectifiers of alternating current. In Fig. 568, the cathode (filament) is kept hot by an alternating current through a transformer. Through another transformer, potentials are applied to cathode and anode. The potentials upon the cathode and anode are changed rapidly by the alternations of the power supply. Current will flow in the anode circuit when the anode is positive and will not flow when the anode is negative, thus suppressing one direction of current and permitting the remaining current to flow as impulses always in one direction. This is a charging system for the battery A of Fig. 568.

For detectors in radio telephone systems, devices of crystal form, cat-whisker form, or other construction, as well as a detector of the electron-valve form, may be represented by the rectifier symbol or uni-directional symbol of Fig. 446 to 450.

The symbols of Figs. 563 to 565 will be found in many diagrams other than radio telephony (such as television, picture transmission, telegraphs and speech-current repeaters in telephone lines) but the manner of reading, as a relay, will apply in all instances.

The radio telephone set for receiving broadcast energy is equipped with variable condensers or other variable units, operated by knobs which are associated with dials and pointers to facilitate resetting to any predetermined position. This function of adjustment is represented easily and logically by showing its concomitant pointer. Fig. 569 shows a symbol for adjustable resistance; Fig. 570, for adjustable inductance; Fig. 571, for an adjustable inductive linkage between two coils; Figs. 572 and 573, for adjustable condensers; Fig. 574, for a complete radio telephone receiving set.

(The End.)

McHenry Again Selected by Missourians as State Chief

Kansas City, Mo.—Houck McHenry of Jefferson City and the rest of the officers who were associated with him in piloting the Missouri Telephone association through the last twelve months were returned to office at the annual convention of the state organization held at Hotel President, here, November 9 and 10.

The re-elected executive roster: President, Houck McHenry, Jefferson City; first vice-president, A. M. Benedict, Richards; second vice-president, S. D. Thompson, Cameron; third vice-president, G. W. Schweer, Clinton; fourth vice-president, W. N. Wicks, Willow Springs; treasurer, V. E. Chaney, Kansas City, and secretary, Robert W. Hedrick, Jefferson City.

Members of the executive committee: W. H. Bassett, St. Louis; E. C. Blomeyer, Kansas City; C. W. Boutin, Cape Girardeau; M. L. Golladay, Holden; R. A. Guthrie, Kansas City; S. T. Neill, Clinton; S. D. Thompson, Cameron; H. C. Todd, Maryville, and C. A. Vedder, St. Louis.

More than 300 Missouri telephone men and women attended a meeting that presented a well balanced and practical program. Missouri had but little to say on the subject of sales and mergers, being content to take this activity as a hastening of the survival of the fittest. M. L. Golladay of Holden, general manager of the Middle States Utilities Co. of Missouri, referred to the purchases of struggling companies, wherein operation was transferred to companies of some opulence, as being a godsend to the weaker companies, as well as to the communities requiring better service. He touched upon the opportunities for improvements in service and consequent higher revenues that were possible in parts of the state.

The spotlight was put on some of the most frequent errors in telephone accounting by H. W. Ross, chief accountant of the Missouri Public Service commission, in his address on "Importance and Necessity of Telephone Accounting from the Commission Viewpoint." He stated the most frequent mistake was that of failure to record properly the effect of replacement of property in the plant account. Another mistake he mentioned was failure to make proper deductions from the plant account for property retired and not replaced. "The point to be emphasized in connection with the plant account," said Mr. Ross, "is that it should reflect at all times the actual cost of the existing used and useful property."

Keeping income accounts on a matured or cash basis, rather than on an accrued basis, is another common mistake in telephone company accounting, mentioned by Mr. Ross. He also went into the theory of depreciation and compared the straight-line method of calculating the annual accruing depreciation with the sinking fund and annuity methods. He referred to the depreciation reserves of some companies as having been built up too rapidly, and pointed out the reasons for this error.

Mr. Ross ended his remarks by stating:

"For a small company, only five principal books are necessary, namely, a general ledger, a journal, a cash book, a voucher register, and a subscribers' ledger; if desired the cash book and journal may be combined. Then, too, by a very small company, the voucher system may be dispensed with, provided the accounts payable are properly journalized and the invoices are properly marked and filed. At times it will be found desirable to provide special printed forms, but these need not be extensive or complicated.

"In conclusion, it should be mentioned that the accounting department of the public service commission is at all times available to the utilities of this state, and they are invited to communicate with that department whenever any accounting problems arise concerning which advise is desired."

A Million in 1950.

In 1950 there will be more than a million telephones in Missouri, according to the statement of James N. Holsen, St. Louis, economic engineer for the Southwestern Bell, made as part of his address of "The Situation and Outlook of Agriculture and Industry in Missouri." In 1950 he expects that 70 per cent of the state's families will have telephones, instead of the present percentage of 45; 85 per cent to 90 per cent of businesses, instead of the present 70 per cent and 80 per cent of the farms, compared with the present 61 per cent.

He forecasts the next 10 to 20 years as destined to be greater than any previous period in the state's history.

J. W. Walton, president of the Oklahoma Telephone Co., believes that the future of the smaller telephone company will be absorption by the individuals or companies owning exchanges in neighboring larger cities and towns. He gave this opinion as part of an interesting address on what's ahead for the smaller companies. Walton spoke from his own extensive experience in forecasting a solution of the rural telephone problem as satisfactory as that attained by the electric companies. He referred to the operation of Automatic Electric, Inc., switching units in rural communities as making the nearest approach he knew to "high line" telephone service, with a local bank handling collections. Collections of smaller exchanges can be brought up to the standards of the larger cities if handled correctly, said Walton, and cited one of his own companies to prove his case. He outlined his company's agency agreement contract, it being practically the same as that employed by the Southwestern Bell, and told of his company's plant inspection work. An annual patrol of the rural lines is made, and whatever work possible is done on the job. The company maintains its own repair shop for equipment in charge of a competent man, who also assists wire chiefs in maintenance of central office equipment. Be prepared to meet the demand or rural districts adjacent to small exchange communities, concluded Walton.

Root of Evil.

"The worst thing the telephone business is afflicted with, and addicted to, is 'bum mechanics,' 'would-be' workmen or craftsmen, 'half-baked' linemen, inspectors, troublemen, etc.," declared A. M. Benedict, owner-manager of the Richards (Mo.) Telephone Co., in a lively and valuable narration of his experiences with telephone mechanics.

Less than 10 per cent of the men who

(*Continued on page 39*)

Pacific's Newest Super-Ship Has Model Phone Service

By C. F. FAIRLY

(Los Angeles Manager, Kellogg Switchboard & Supply Co.)

Stateroom of "City of Honolulu" shows Kellogg "Grabaphone" installation as part of the de-luxe equipment.

There is scarcely a day that we do not learn of a new central office installation, a new addition to a present switchboard or an old board being modernized by the installation of improved features. These installations are all more or less of a general type and for utility use. It is somewhat out of the ordinary, however, to learn of a modern telephone installation on an ocean liner and is of unusual interest because of the different conditions that must be met.

The Los Angeles Steamship Co. recently added the S.S. "City of Honolulu" to its fleet of luxurious liners in service between Los Angeles and the Hawaiian Islands. The work on this palatial steamer was done at the yards of the Los Angeles Ship Building & Dry Dock Co., San Pedro, Calif., under the direction of Pillsbury & Curtis, naval architects, and under the personal supervision of Walter L. Martignoni of that firm.

In designing the "City of Honolulu" for service between Los Angeles and Hawaii, every effort was made to provide the maximum of space and facilities for the passenger's comfort and enjoyment. In addition to wide decks, both glass-enclosed and open for promenades and deck-chair lounging, the main afterdeck of this steamship provides exceptional opportunities for all manner of deck sports and games.

Unusually spacious, handsomely-decorated and appointed public quarters are provided in the grand dining salon, with seating capacity for 330 people. Then there are the splendid music salon, writing-room, smoking-room, veranda cafe tea-room and garden lounge. Included in the luxurious conveniences is a magnificent Pompeian tiled swimming pool, equipped with dressing-rooms, steam-rooms, showers and rubbing-parlor, and with a hand-ball court adjoining. Off the boat deck, directly above the veranda cafe tea-room, is a fully equipped gymnasium, in charge of a competent instructor. The gymnasium also has its steam-room, shower and rubbing table equipment in quarters adjoining.

Electric passenger elevator service connects all decks.

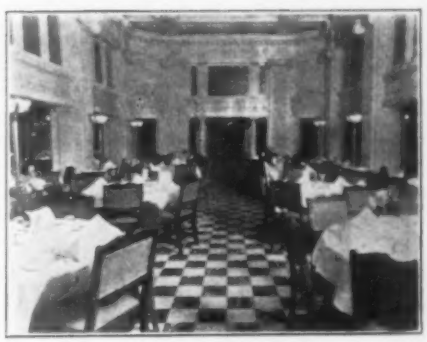
Every stateroom has one or two regular single beds and nearly 70 per cent of the staterooms have either a private or a connecting bath—and all have hot and cold running water, electric fans, heaters and telephones.

Has Kellogg Service.

In keeping with the idea of rendering a first-class service, no little consideration was given to the matter of communication. A contract was entered into with the Kellogg Switchboard & Supply Co. to furnish and install a complete telephone system, consisting of a single position, two-panel switchboard, wired for 320 common battery lines, with a present equipment of 260 working lines. This up-to-date telephone equipment includes four jack-ended trunk circuits with night jacks and an automatic calling device, ten double lamp supervision cord circuits, night alarm, line and supervisory pilot circuits, as well as other common equipment.

Line terminals, cord relays, etc., are mounted on a swinging gate inside the cabinet to render easy access to all parts.

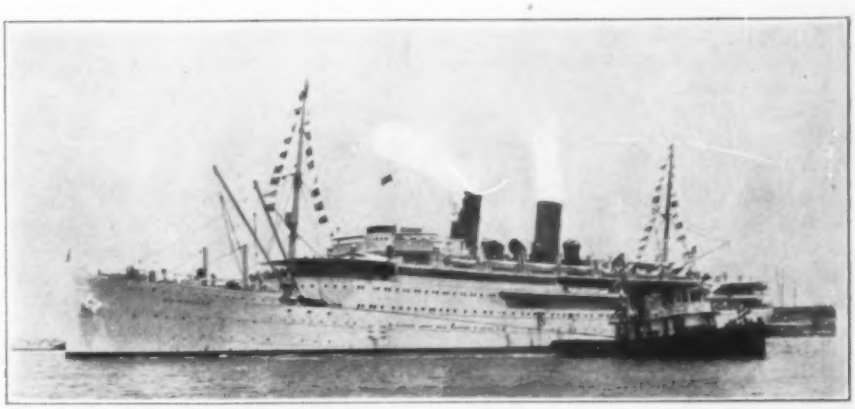
The board was constructed and assembled under rigid marine specifications as a safeguard against moisture and salt air. The cabinet was given a heavy waxed hand-rubbed outside finish, and, in addition, two extra coats of shellac were applied to the inside, so as to prevent warping. All iron work was especially treated to prevent rust, and all apparatus was mounted with brass screws, bolts and washers.



Dining salon of new Pacific super-ship pales many of the ritziest of the shore eating places.

The relay coils were wound with enameled wire on bakelite spool heads, which were sterling varnished. All wiring was of two silk and one cotton insulation, and the forms were taped with empire cloth, wherever they came in contact with the iron framework.

The power equipment consists of two sets of Exide marine type enclosed storage batteries, with rubber jaws, which are mounted in a special battery cabinet. A standard power board is equipped with voltmeter, ammeter, switches, rheostats, fuses, circuit breaker and necessary apparatus for control of the charging, ring-



This is the new Pacific liner on which Kellogg put telephone equipment that is claimed to be the last word in ship telephone installations.

ing machine, and operation of the telephone switchboard.

The ringing machine consists of a motor generator set, direct connected on a heavy slate base and mounted on the same pipe standard that supports the power board. It is designed to operate from 115 volts D.C., furnished by the ship's generators.

All power wiring was pulled in conduit as an added protection against fire.

The wiring of the steamer was carried out on the same basis as a large hotel or office building. Cables from the switchboard rack were distributed to convenient terminal points on each deck and from the various terminals, carried to the staterooms by means of lead-encased rubber telephone wires.

Wiring a Problem.

All wiring, including the cables, is of the lead-covered type, and wherever the lead covering was removed at terminals or stations, the exposed ends were treated with a moisture-proof compound. All cabling and wiring had to be concealed between decks and securely fastened to prevent chaffing, because of vibration. A considerable problem was encountered in running the cables and service leads. Practically every two feet it was necessary to drill through the iron beams of the ship, and, as an added precaution, the hole through each beam was lead-bushed, to prevent any damage from vibration. The cable between beams was strapped to the steel plates of the ceiling above by brass machine screws and Long Saut cable clamps, which were lined with lead strips, as an added precaution.

Provision for trunk connections were made for the use and convenience of passengers and officers while the ship is in port. Consideration had to be given to the difference in equipment used at Wilmington, Calif., her home port, and Honolulu, Hawaii, her mid-Pacific port. Four trunks in all were provided: two for manual service at Wilmington and two of the automatic type for use while in the port of Honolulu. All four trunks were carried to either side of the boat and terminate in heavy brass moisture-proof jack boxes. A long moisture-proof extension cord, with plug accommodating two trunk lines, was provided, so, that immediately after docking, the ship's switchboard can be connected to the city trunk lines.

The S.S. "City of Honolulu" provides for the accommodation and the most comprehensive entertainment of 445 first-class passengers. Her richly appointed de luxe suites, comprising bed-room, sitting-room and bath, and all her handsomely-furnished and decorated staterooms, which are unusually spacious, high-ceilinged, and well ventilated, demand a telephone instrument that harmonizes with the beauty of the rooms, and gives the best of service. For this reason, Kellogg desk type Grabaphones, with the new enclosed type desk set boxes, were installed.

The S.S. "City of Honolulu" made its maiden voyage on Saturday, June 4, 1927, and is scheduled to sail every 28 days thereafter. The first trip was made a gala event, and included the annual excursion of the Los Angeles Chamber of Commerce to the Hawaiian Islands. Every convenience for the entertainment of the excursionists was provided. Even a broadcast station was provided, under the supervision of "Uncle John," popular announcer of KHJ of the "Los Angeles Times," and a number of their artists. Daily programs, broadcast from aboard ship while en route, were easily picked up from the mainland.

A close inspection of the palatial steamer, as she was about to steam out of Los Angeles harbor, convinced many visitors that the Los Angeles Steamship Co. is doing everything possible to maintain its established reputation for complete, efficient and courteous service.

CANNON ADDRESS ILLINOIS FEATURE

(*Continued from page 26*)

its members' willingness to do everything possible for employe welfare came to light when E. D. Glandon told what had been done with legislation on the women's eight hour day. He pointed out that such a law would involve considerable inspection trouble and expense and that women operators generally were not favorable to it. He called upon the members of the association to make the places where their women work more comfortable, convenient and homelike.

The wave of exploitation of telephone properties is receding according to President F. B. MacKinnon of the U. S. I. T. A. who spoke in opening the Friday morning session of the convention. Telephone properties cannot be profitably exploited and the promoters already are trying to "pass the buck" to other overly-optimistic parties, said the Independent chief. There is danger that in the failure of some of the over-promoted properties failing to keep their securities sound the entire financial structure of the Independent field may suffer, warned MacKinnon. He complimented the Illinois Commerce Commission on its handling of the exploitation threats in the state.

He referred to disregard of depreciation by some promoters and discussed depreciation and maintenance practice of 24 class A companies. Class A companies in Illinois in 1926 showed a growth of 5 per cent, class B companies 1.7 per cent and class C companies none.

In further comment on the consolidations, Mr. MacKinnon expressed confidence that the Independent group will come out of the situation better than it went in.

Never inaugurate a rate case without taking subscribers into the confidence of the company, advised A. R. Bone, general commercial superintendent of the Illinois Bell, in speaking on the commercial department's interest in rates. If the company does the job right the subscribers will go to the extent of sending representatives to testify before the commission in the company's behalf. He described the various features of the telephone business that distinguished it from other business enterprises, even from other utilities, and showed the effect of these factors in rate making and the companies' profits. He concluded by making the commercial department the point of common ground between the subscribers and the internal interests of the company when rates were under consideration.

W. S. Vivian, manager public relations department of the Middle West Utilities Co., in speaking on "The Basis of American Prosperity," traced the development of American prosperity along lines of individual enterprise and warned against encroachment of government in business. Mr. Vivian also spoke before the lively and practical conference of operators which was held during the convention.

An accounting open forum with V. E. Chaney in charge and a plant conference presided over by J. Howard Matthews, assistant chief engineer of the Illinois Commerce Commission, were two of the informal discussion sessions that added much to the definite value of the meeting.

J. K. Johnston, secretary of the Independent Pioneer Telephone Association, spoke briefly on the aims of that organization and asked for additions to the association's collection of historical items.

Grace, Miracle Man, Demonstrates

S. P. Grace, general commercial engineer of the Bell Telephone Laboratories, Inc., in telling about and demonstrating some of the latest discoveries and inventions of the Bell laboratories, again treated telephone men and their guests to the thrill that he sent through his audience at the U. S. I. T. A. convention at Chicago in October.

The marvels of "synthetic language" transposed into intelligible vernacular by switching frequencies provided one of the marvels. The artificial larnyx was demonstrated as was a telephone receiver for instruction of the deaf. Getting into the applications of imminent practical interest to his audience, Mr. Grace talked over loading coils, exhibiting samples of permalloy core material, vacuum tubes, high speed relays and carrier currents. He referred to the discovery of Dr. Johnson that every electrical conductor is a spontaneous generator of electricity, and of Dr. Davison, who in investigating crystals, found electrons obey the laws of waves.

LINE AND DESK

WHAT THE WOODPECKER DOES TO US.

Our familiar friend, the red-headed woodpecker, who has earned his right to exist through his ravenous appetite for insects, also delights in using his chisel-like bill on telephone poles, and his bombardment of the wire carriers cost our company $13,000 to replace these poles last year in Iowa alone, it is estimated. On 737 miles of line inspected last year in the Iowa division, 589 poles were condemned for replacement because woodpecker holes had weakened the poles below standard strength. The damage by the red-headed bird to these poles, which otherwise would have given many more years of service, cost us nearly $18 for every mile of line involved.

It is expected the increased use of creosoted pine poles, which at present have proved to be too tough for the woodpeckers to tackle, will aid in reducing the damage done by the birds. However, it is possible that when the supply of nice soft cedar poles in our plant diminishes, the woodpecker may resent the efforts to prevent his mischief, and adapt himself to the harder poles.—Conrad J. Johnston, in The Northwestern Bell.

STAYS WITH AIR JOB AND KEEPS ON EARTH.

Telephone workers had some thrilling experiences during the St. Louis tornado last September, but few will envy that of W. P. Tietjens, cable splicer, who went through the tornado atop a telephone pole on Spring avenue.

He was making a splice when the tornado arrived. When he became aware of his danger, it was too late to climb down, so that all the time the wind was striking with all its fury, he was entangled in the ropes and tarpaulin. Had he seen his predicament a minute earlier and started to climb down the pole, he probably would have lost his life, for when the inky darkness lifted, it was found that a metal garage building had wrapped itself neatly around the pole. His devotion to duty in taking a couple of moments to protect his splice from the elements, thereby rendering his escape impossible, prevented the garage from also wrapping itself around him. Incidentally, the splice was saved, but the cable itself was ruined.

Tietjens escaped with a cut on his leg.

OLD AND THE NEW IN RIVER CROSSING FIXTURES.

The difference in type between old and new river crossing fixtures across the West Peral River on the Birmingham-New Orleans line of the American Telephone & Telegraph Co. is shown in a photograph in a recent number of *Long Line*. The original fixtures were "A and Mast" type, 110 feet high, and were built in 1904. The new fixtures are H type, and are 90 feet high.

When you're checking over the year see what cords cost you

YEAR after year managers who keep close records on cords find that Runzel-Lenz cords give exceptionally low cost figures due to the uniformly steady and long-lasting service supplied.

We work for you on the basis that if everything that goes into a cord is of the highest grade, the completed cord is certain to satisfy. That's why we have a testing laboratory that subjects every ounce and every inch of raw material to the most exacting tests before acceptance.

The men and women who make Runzel-Lenz cords form the most experienced corps of cord-making specialists in the world. Many of these experts have been with us for almost all of the three decades Runzel-Lenz has focused its efforts on telephone cord manufacturing.

Check up every detail of your cord costs and compare your figures with some of your neighboring managers who are using Runzel-Lenz cords. Then you, too, will standardize on Runzel-Lenz.

Runzel-Lenz Electric Mfg. Co.

Specialists in the Making of All Telephone Cords

1751 N. Western Ave. Chicago, Ill.

Terre Haute Now Clicks "Dial of Destiny"

Terre Haute, Ind.—Mayor Ora D. Davis beat the milkman out of bed Sunday morning, November 27, for at 5 a. m. Hart F. Farwell, president of the Citizen's Independent Telo. Co., dialed his honor as the first call over the full Strowger automatic system of the Citizen's company. The mayor's early awakening on this historic occasion had all the atmosphere of an eager youngster turning out before daybreak Christmas morning, as the automatic cut-over brought to the Hoosier city equipment representing a welcome present in any municipality's array of treasures.

The 11,100 lines of automatic equipment form two units, Harrison office and Crawford office, both housed on the third floor of the telephone building. Of this equipment, there are 7,000 individual lines, 3,200 four-party lines, 700 P.B.X. lines (using rotary connectors), and 200 ten-party lines. The 3,200 four-party lines are handled in the Harrison office, and come in through a line I.D.F. on a terminal per station basis. Five-frequency harmonic ringing is used.

Plunger type primary line switches are used, with rotary type secondary line switches. First, second and third selectors are used, with a special train of toll switches for the use of the Bell long distance operator. Special desks furnished are as follows: A four-position information desk, a six-position intercepting desk, a four-position test desk and a two-position repair clerk's desk.

Power equipment consists of two motor-generator sets, one producing 300 amperes at 50 volts, and the other 150 amperes at 50 volts. They both operate from the commercial power of 440 volts, 60-cycle, three-phase. A 50-ampere rectifier is also furnished which operates on 220 volts, 60-cycle, single phase. For emergency purposes a 350-ampere, 50-volt gas engine generator set is provided.

Rotary ringing machines furnish ringing current, there being duplicate sets which furnish four frequencies—namely, 16 cycles, 33 cycles, 50 cycles and 66 cycles. The other frequency, 25 cycles, is furnished by another duplicate set of rotary machines, which are also equipped with tone commutators and interrupters. The battery is ample for all ordinary needs, and the power scheme is designed to operate on a full float basis.

The building occupied by the new headquarters of the Citizen's company is a remodeled garage building, and provides ample room, light and other requirements. There is a very pleasing scheme of interior finish for the company's offices.

The first floor of the telephone building is given over to the general commercial offices of the company. The second floor contains the executive offices, the engineering and the drafting departments. The Strowger automatic equipment occupies the third floor together with the information and other special desks. The storage battery and battery charging equipment are in the basement.

Terre Haute was made aware that the new automatic installation made history for the city, as the telephone company and local newspapers co-operated in getting out excellent special editions covering the event.

To usher in Terre Haute's new automatic service there was a galaxy of local and visiting notables, including the following officials of Citizens Independent Telephone Co.: Hart F. Farwell, president; Maro B. Farwell, commercial manager; A. L. Stadermann, secretary and engineer; Fred Davis, plant engineer; S. B. Dibble, superintendent of equipment, and M. F. Hayman, traffic manager.

J. G. Crane, president of Diversified Investments, Inc., of Kansas City, Mo., was present, together with John Wopat and H. M. Cox of the same organization.

Others present were C. H. Rottger, president of Indiana Bell Telephone Co.; Russell Rottger, vice-president and general manager of Danville Telephone Co., Danville, Ill.; C. M. Bowling, manager of Wabash Valley Telephone Co., Paris, Ill.; F. E. Bohn, vice-president and general manager; L. E. Moore, director; W. W. Bogart, director; H. J. Gray, general superintendent, and Frank Staub, equipment engineer, all of the Home Telephone & Telegraph Co., Fort Wayne, Ind.; and W. R. Brown, chief engineer of LaFayette Telephone Co., LaFayette, Ind.

Automatic Electric, Inc., Chicago, was represented by R. H. Burfiend and C. S. Caldwell, sales department; Dr. A. B. Smith, chief research engineer; T. E. Meyer, superintendent of equipment engineering, and W. H. Perkins, operating department. M. Abt was in charge of the work of installation, assisted by I. P. Olson.

Copperweld Names Department Heads

Glassport, Pa.—With the removal of its main office from Rankin to its new 20-acre mill at Glassport, Pa., the Copperweld Steel Co. announces that headquarters of both the Sales and Engineering Departments will be at Glassport. The personnel of these departments as now constituted is as follows:

Robert J. Frank, Vice President in Charge of Sales.

Stanton Hertz, formerly Electrical Engineer, becomes Sales Manager.

Rolf Selquist, formerly Assistant Electrical Engineer, has been appointed Electrical Engineer.

Wm. Jay McIlvane has been appointed District Manager, with headquarters at New York.

Erich G. Elg becomes District Manager, with headquarters at Chicago.

S. H. Burr, formerly inspector and line material specialist, at both Buffalo and New York offices of the Graybar Electric Co., has joined the engineering department of the Copperweld Steel Co., of Glassport, Pa., with headquarters at New York.

Puyallup, Wash.—Plan sale of Puyallup Valley Home Telo. Co. to Pacific T. & T. Co.

Public Utility Financing

P. W. CHAPMAN & CO., INC

170 W. Monroe St. Chicago — 42 Cedar Street New York

Boston Albany St. Louis Milwaukee Grand Rapids New Orleans Seattle Portland San Francisco

MISSOURI HOLDS ANNUAL MEETING

(Continued from page 34.)

came to him with references and reputations as linemen and trouble mechanics could be trusted to do thorough and finished work without being carefully watched, Benedict mourned. Nine out of ten of them men had just picked up what they knew, or thought they knew, and were not qualified as telephone craftsmen either by natural ability or training, he further said. Benedict classified the major class as the destructive mechanics, who tinker around to see "what makes the wheels go," and the minor aggregation as the constructive mechanics, who work to some practical result in a thoughtful and neat manner.

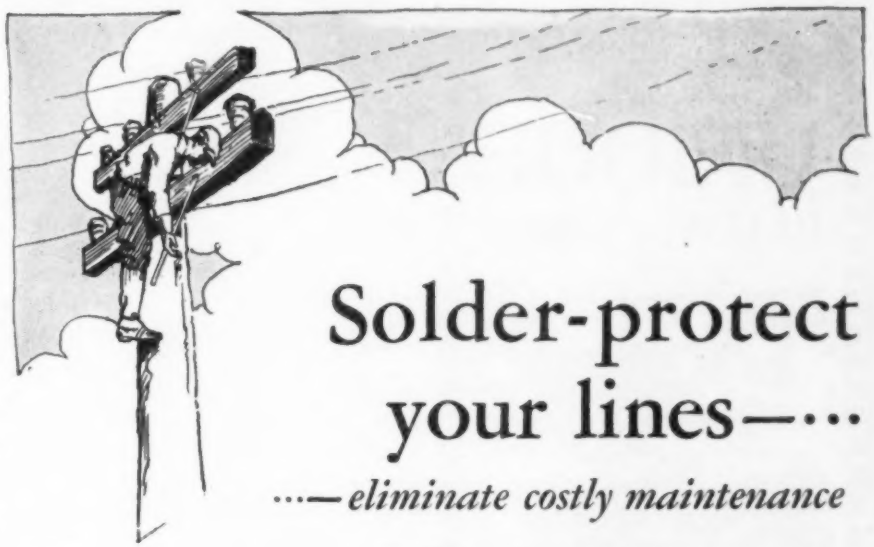
Benedict's address put across an impressive message in reminding many of his hearers that they were not giving the telephone mechanics enough special training, and that this deficiency was showing up, with sad results, in every phase of the smaller companies' business. He cited a number of examples in bringing out the need for a system of apprenticeship, a training school or some other method for better training or selection of telephone workers. He called attention to the fact that a large number of fair-sized county seat telephone companies had big investments in delicate electro-mechanical equipment that was at the mercy of utterly incompetent mechanics.

At the finish of his excellent address, the Richards man advised, "let's all go to it and clean house of all the half-baked, worthless linemen and trouble-shooters before some state commission steps in and starts cleaning them out for us."

Another exceedingly practical address was that of B. H. Piepmeier, of Diversified Investments, Inc., who spoke on "Telephone Lines on the Highways." From his previous experience as chief engineer of the Missouri Highway commission, Mr. Piepmeier presented both sides of the telephone and highway commission tangles, and pointed a way to harmony in suggesting that telephone companies keep in close touch with the highway interests, who, in many cases, do not realize that their actions may have some reflection in telephone rate-making. Memorial trees should be placed at least 50 feet inside of the property line for proper maintenance and protection by the property owners, Mr. Piepmeier advised.

Notables Featured.

"Telephone Scandals of 1927," a playlet written by Frank Shoup, Arthur Thorpe and Douglas Williams, and having several of the Southwestern Bell's belles in the cast, was the feature of the annual banquet. Houck McHenry, P. Kerr Higgins, J. G. Crane, M. L. Golladay, G. W. Schweer, R. W. Hedrick and L. M. Kraege were subjects of the playlet's script.



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···—*eliminate costly maintenance*

KESTER
***Acid Core* SOLDER**

For all iron lines use Kester Acid Core Solder. The scientific flux in Kester is less corrosive than the alleged non-corrosive pastes now on the market. It is much cleaner and far more active. Packed on one, five, ten and twenty pound spools, and one pound coils in cartons. Standard gauge No. 3 about 1/8 inch in diameter. (Can be furnished in several alloys and many gauges.)

KESTER
***Rosin Core* SOLDER**

For all switchboard and inside work use Kester Rosin Core Solder. Absolutely non-corrosive, pure rosin flux inside this genuine solder makes it safe, simple and sure on any delicate job. Packed on one, five, ten and twenty pound spools, and eighteen inch lengths in five pound boxes. Standard gauge No. 5 about 3-32 inch in diameter. (Can be furnished in several alloys and many gauges.)

Samples upon request

EVERY joint in a telephone system is a potential trouble maker unless it is *solder-protected*. The time spent in finding these high-resistance joints on intermittently open and closed circuits causes the unnecessary expense that cuts too deeply into the net profits.

Line splices and sleeve connections—unprotected by solder are an outstanding example. Mechanical joints, which at the start may prove satisfactory enough, will have but a short life before trouble starts.

Subjected to all outdoor conditions, the splices or sleeves are constantly affected by temperature changes causing expansion and contraction—the joint loosens. Smoke, water and ice get in their share of the damage—swaying with the wind, vibration from numerous sources finally conquer every mechanical joint. Then costly trouble-shooting commences—the offending joint is finally found after perhaps hours and even days and months of hunting. As a means of repair, the joint is promptly "bridged"—and if unprotected by solder there are two sources of further trouble. No wonder telephone officials bemoan the high cost of maintenance—···

Solder-protect your lines, new or old —eliminate unnecessary maintenance

Kester Acid-Core wire solder on each outside connection makes any mechanical joint electrically secure. A splice can be soldered with Kester in less time than it takes to apply sleeves or bridges, and at a fraction of the cost. Kester with its self-fluxing feature cuts ordinary soldering time one-third—it is easy to use. Underwriters Laboratories examined.

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Manufactured by

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ORIGINATORS AND WORLD'S LARGEST MANUFACTURERS OF SELF-FLUXING SOLDER

Sycamore, Ill.—De Kalb-Ogle Telo. Co. has bought Killibuck Telo. Co. of Monroe Center.

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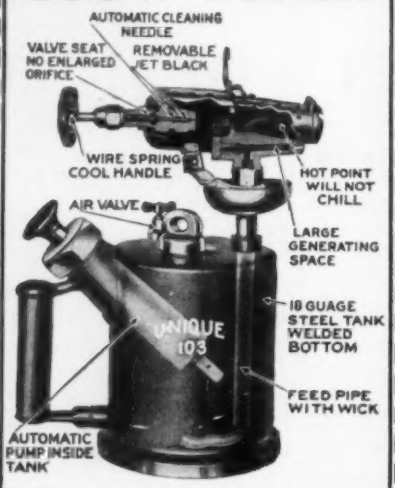

It starts quickly, operates in any position, and produces a remarkable heat. It is a great worker in cold and windy weather.

The automatic orifice cleaner, one of the details shown in the illustration, is but one of a number of exclusive features that make the Unique your greatest value in blow torches.

Painstaking care by interested workmen, an actual "burning test" before shipping, is just another detail responsible for their uniformity and efficient burning qualities.

Write for complete details

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221 Whiting St. CHICAGO, ILL.

Condensers

W. E., 2-MF, Code No. 21D, 21-E, 21-L	$.50
W. E., 1-MF, Code No. 21-F, 21-K	.35
Kellogg, 2-MF, Code No. 36	.50
Kellogg, 2-MF, Code No. 64	.35
Kellogg, 1½-MF, Code No. 41	.40
S. C., 1-MF, Code No. 18	.35
S. C., 2-MF, Code No. 19	.50
S. C., 2-MF, Code No. 22	.50
S. C., ½-MF, Code No. 26-T	.30
Dean, 1-MF, Code No. 1110	.35
Dean, 1-MF, Code No. 5785, twin	.75
North, 2-MF, Code No. 8	.25
Mansbridge, 2-MF, new	.85
Mansbridge, ½-MF, new	.50
Mansbridge, 1-MF, retested	.35
Mansbridge, 2-MF, retested	.50

BUCKEYE TELEPHONE AND SUPPLY COMPANY
COLUMBUS, OHIO

Canada and Mexico Linked by Telephone

Montreal, Can.—Another step forward in the linking up of nations by telephone has been made with the inauguration of long distance telephone service between Mexico and Canada. The International T. and T. Corp., in conjunction with the American T. and T. Co., and the Bell Telephone Co. of Canada, arranged for conversations to be exchanged between Mexico City, Montreal and Toronto.

Telephone service between Mexico City and these Canadian points is carried over one of the longest commercial wire telephone circuits in the world, covering a total distance of 3,381 miles. Starting from Mexico City over the lines of the Mexican T. and T. Co., the circuit proceeds to San Luis, Potosi, Saltillo, Monterrey, Laredo, to the Mexican border, thence over the long lines of the American T. and T. Co. by way of San Antonio, Dallas, St. Louis, Chicago and Toledo, where the line branches and proceeds to Toronto by way of Detroit and to Montreal by way of New York. The inauguration ceremonies took place in Mexico City, Montreal and Toronto at 3:30 p. m., Eastern Standard Time.

Sir Frederick Williams-Taylor, General Manager of the Bank of Montreal, exchanged greetings with D. B. Emeno, Manager of the Bank of Montreal, who is now in Mexico City. Sir Henry Thornton, President of the Canadian National Railways System, who is now in Mexico City, spoke to S. J. Hungerford, Vice-President of the Canadian National Railways, and Major Graham Bell, Deputy Minister of Railways, Montreal, and nephew of Alexander Graham Bell, inventor of the telephone.

Following these conversations from Montreal, the circuit was turned over to Toronto, where Sir John Aird, Chairman of the Board, Canadian Bank of Commerce, exchanged greetings with E. J. E. Stevenson, Manager of the Canadian Bank of Commerce in Mexico. G. R. G. Conway, President of the Mexican Light and Power Co., talked to Miller Lash, Chairman of the Board, Mexican Light and Power Co., who is in Mexico City. This concluded the ceremonies, and the circuit was once more turned over to Montreal, and Colonel W. F. Repp, Vice-President of the Mexican T. & T. Co., and C. F. Sise, President of the Bell Telephone Co. of Canada, then declared the new long distance service open to the public.

New **Hotel Eitel** *Chicago*

The Next Time You Come to Chicago make your visit a splendid success by stopping at this beautiful new hostelry.

Room and Bath, 1 person —$3.50, $4, $4.50, $5
Each additional person, only $1
Room and Bath, twin beds—$6, $7, $8

Under the personal supervision of ROBERT J. EITEL and MAX EITEL

Delaware Place at Rush St.

Just a few blocks from the Loop

Kearney Issues Six New Bulletins

St. Louis, Mo.—James R. Kearney Corp., 4224 Clayton avenue, has issued six new bulletins, covering new products now being marketed. These are: Bulletin No. 311, the new Double Duty Fuse and Disconnect Cutout, enclosed in Plastic Wet Process Porcelain, not cast, and not pressed; Bulletin No. 312, Kearney Convertible 7500V and 15000V Switching Equipment; Bulletin No. 314, Kearney Handy Fuse Pullers; Bulletin No. 327, Kearney C. G. Hot Tap Clamp; Bulletin No. 328, Kearney Economy Cable Clamps; Bulletin No. 329, Kearney "No Serve" Yokes, Splice Balls and Clevises.

Northfield, Minn.—Tri-State T. & T. Co. has bought Northfield Telo. Co.

BRIDGING twisted pair to twisted pair, a practical application of the Kearney Solderless Service Connector.

FOR Telephone Lines in making party line taps, order Catalog No. 86. The tap can't slacken off. This connector is for No. 12 wire or smaller.

Unassembled Connector

ASK ABOUT KEARNEY CERTIFIED MALLEABLE SCREW TYPE ANCHORS

Kearney Guy Wire Serving Clips. Eliminate Serving End of Strand. Made of Aluminum, Copper, and Galvanized Iron.

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

4226M Clayton Ave.

E. H. Moulton, Independent Leader, Drops Dead

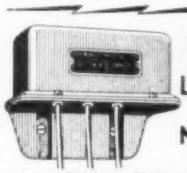
Pasadena, Calif.—Edward H. Moulton, 84, former independent telephone magnate and banker of Minneapolis, Minn., dropped dead of a heart attack, Nov. 12, in the office of Charles L. Wright, president of the Security National Bank. He had returned to Pasadena two days prior to his death from an extended European trip with his daughter, Mrs. Catherine Van Dyke.

With the passing of Mr. Moulton, death again takes toll from the ranks of those who established the Independent telephone industry. He resigned the presidency of what was then the largest bank in the northwest to turn his talents to bringing the old Mississippi Valley Telo. Co. out of its serious financial plight, and in his 14 years of service with this company saw it grow to be one of the largest Independent telephone companies in the country, now known as the Tri-State T. & T. Co. For more than 11 years Mr. Moulton was president of the Tri-State, being succeeded upon his retirement in 1914 by George W. Robinson.

He was elected president of the old International Independent Telephone association in December, 1908, and served for a year.

American Interests in Paris Automatic Work

Paris, France.—Report of the Etablissements Industriels de Grammont states that the company has been induced to form, with the co-operation of the Western Electric Co. and the General Electric Co. of London, a subsidiary company under the title of the Société des Telephones Grammont, with a share capital of 18,000,000 fr. This company has been entrusted by the French Postal Administration with the construction of a part of the automatic telephone system in Paris.



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Western Elec. No. 1317 2 or 3-bar 1000, 1600 or 2500 ohm Bdg. compacts @ $8.25—with Stromberg 4-bar Gen. @ $9.00—5-bar @	$10.00
Federal Brand New 4-bar 1000 ohm Bdg. Grab-a-Phones @	8.50
Federal Brand New 4-bar 1600 ohm Bdg. Grab-a-Phones @	9.00
Cook No. 10 Arresters, per bank of 20 lines @	8.50
Cook No. 8 Arresters, per bank of 20 lines @	8.00
Stromberg No. 599 type 4-bar 1000, 1600 or 2500 ohm Bdg. compacts @	6.90
Bunnell 50 ohm Automatic Pen Registers. Register calls from Police or Fire Alarm boxes @	20.00
Kellogg No. 20-A Cord Ckt. Repeating coils @	1.25
Kellogg No. 128 Twin Swbd. condensers @	1.00
Leich Elec. No. 7A Frequency converters @	37.50
Bunnell Telegraph Keys @	.50
General Elec. (THOMAS), A. C. Ammeter. Scale 0 to 2 amps. @	5.00
Dean Elec. 3-bar 1000, 1600 or 2500 ohm Bdg. desk sets @	8.75
Kellogg No. 28 3-bar 1000, 1600 or 2500 ohm Bdg. desk sets @	9.50
Western Elec. No. 296A Straight line C. B. Wood hotel sets with No. 229 Trans., No. 143 Rec., No. 20 Coils and 2500 ohm ringer @	6.50
Menominee Elec. Extra Heavy duty Swbd. Gen., complete with mounting screws, crank, etc., 6-bar @	2.75

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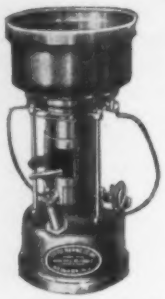

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